HUMBOLDT-UNIVERSITÄT ZU BERLIN

Thomas Aenis, Jue Wang & Susanne Hofmann-Souki (Eds.)

Farmers' willingness to accept land-use changes in Xishuangbanna, China

With Contributions by:
Sophie Bartosch, Pascal Dusold, Junghae Lee, Dahai Liao, Julian Lüdiger, Katharina J. Maier, Sarah K. Mayr, Sisilia I. Yuniarti Pratiwi, Valeria Svart-Gröger

SURUMER

GEFÖRDERT VOM
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Pictures

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Das diesem Bericht zugrunde liegende Projekt
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1 Introduction

1.1 Problem background

Rubber monocultures risk to be neither ecologically nor economically sustainable in Xishuangbanna Dai Autonomous Prefecture, Yunnan Province in the south-west of the People's Republic of China. Rubber has significantly improved farmers' livelihood (AENIS et al., 2014), and during a price boom from 2006 to 2008 many of them have dedicated all their land to rubber. This threatens the unique biodiversity of the region even more, and the share of tropical forest has been reduced in few decades from 70 % to 26 % (WEHNER, 2010).

However, rubber prices are fluctuating and in recent years rubber farmers have been confronted with only one fourth to one fifth of the price in 2013 and 2014. Even though rubber cultivation has been more profitable to farmers than traditional land-use systems such as maize and rice, land-use change towards a monoculture cash crop bears high economic risk exposure as it increases the possibility of plant diseases and makes farmers dependent on climatic as well as economic conditions of one single tree species. The initial investment reduces farmer's possibility to react to changes in external conditions as cultivating one generation of rubber trees is an engagement for about 25 – 30 years (SURUMER, 2015).

The use of agrochemicals in rubber production disturbs important ecosystem services and functions as they are changing water and ecosystem carbon dynamics. Chemical pesticides, fertilisers and herbicides used in rubber cultivation affect a large number of biological processes with negative consequences for soil fertility and hydrological functions. These effects may cause water shortage, contamination of drinking water as well as soil erosion (SURUMER, 2015; MARTIN, 2013).

The Sino-German research project SURUMER was set up in 2011 in order to develop an integrative land-use concept for a more sustainable rubber production in Xishuangbanna that could be similarily applied in other countries of the Greater Mekong Sub-region. One of the three SURUMER project goals is to establish "ecologically and economically sustainable concepts and systems of rubber cultivation, based on the evaluation of trade-offs and synergies between ecological and economic goals and providing baseline models applicable to other tropical land use, especially to production systems of renewable resources" (SURUMER, 2015).

In order to successfully develop and realise sustainable strategies there is a need for knowing the conditions under which these strategies could be implemented. That means that it is crucial to know under which conditions and with which compensations farmers would be willing to accept and adopt innovations / land-use change, as well as what is motivating and what is hindering them. Moreover, there is a need to know about their willingness to induce land use changes themselves. A knowledge gap exists concerning this necessary information - on farmers' willingness to accept and induce land use changes - particularly for the NaBan River Watershed National Nature Reserve (NRWNNR) in Xishuangbanna:

- The value of rubber to the farmers is not exactly known;
- There still is unclarity about farmers' perception of problems concerning rubber production as well as concerning land use change;
- It is unknown what makes farmers accept land use changes induced by others and what motivates them to change their land use on their own initiative.

1.2 Objectives

The objective of this study is to fill the existing knowledge gap and learn about factors that influence farmer's willingness to accept and induce land-use changes. Specific emphasis is laid on farmers' perspective. Expected output is an overview of factors influencing farmers acceptance of changing rubber cultivation and land use - farmers' general attitude towards "greener rubber production" as well as regarding two concrete improvement options from the SURUMER project. From this, consequences are drawn for possible monetary and non-monetary "compensations".

Specific outputs are:

- Overview and clear understanding of the value of rubber cultivation for farmers;
- Overview of problems that farmers perceive in rubber production recently;
- Analysis of the farmers' general attitude towards change;
- Analysis of the factors that influence the farmers' willingness to accept land use changes in general and exemplarily for two innovations as discussed in the SURUMER project: water protection zones and intercropping;
- Consequences elaborated with respect to possible compensations.

This knowledge is indispensable, if integrative land-use concepts and approaches established by the SURUMER project are meant to work not only in theory, but in practice. Such concepts can only be implemented if they are accepted and supported by the farmers. Results of this study must therefore be communicated to key stakeholders in order to enable them to develop, implement and improve already existing policy options and/or plans to raise awareness and to improve knowledge and skills in order to achieve acceptance of sustainable options through the farmers' understanding. In this way the study may contribute to the overall goal of the SURUMER project - sustainable rubber cultivation in the region of Xishuangbanna - and to theory development: further knowledge of important factors influencing farmers' acceptance of land use changes.

1.3 Activities

Objectives were achieved through the following activities:

1. Generation of an overview on rubber cultivation at the global as well as the Chinese national level and the research area, in order to understand why most farmers in Xishuangbanna have specialised in rubber cultivation and which chances and obstacles there might be to alternative or modified land use practices.
2. Development of a theoretical concept of "change" based on theories of motivation and acceptance. Through this, the conceptual framework for the acceptance of land use changes by farmers is developed.
3. Description of two concrete cases from the SURUMER project, namely water protection and intercropping of rubber.
4. Analysis of the value of rubber for the farmers regarding their income and livelihood.
5. Overview on problems as perceived by the farmers, with special emphasis laid on those problems which are connected to rubber production.
6. Analysis of the factors influencing the acceptance of water protection and intercropping.
7. Analysis of farmers' attitude and motivation towards change in general.

2 Theory

2.1 Principles

In economics, the term willingness to accept refers to the minimum amount of money an individual actor agrees on to give up a good or service (HANEMANN, 1991). The difference between willingness to pay and willingness to accept lies in the property of a good or service. If an individual does not have property rights, he can only have a willingness to pay in order to obtain the desired good or service. If, on the other hand, an individual possesses a good or service, he or she will have a certain willingness to accept to forgo the same. The neoclassical economic framework suggests that for a given good, an individual's willingness to pay and his or her willingness to accept would be equal, that is the price at which the individual is indifferent between buying or not would be the same as the price at which the individual would be indifferent between selling or not (KAHNEMANN et al., 1991). However, many studies have shown that the willingness to accept giving up a good is, on average, substantially higher than the willingness to buy the same good (i.a. KAHNEMANN et al., 1991, KNEZ et al. 1985, CORSEY et al. 1987). KAHNEMANN et al. (1991) explain this phenomenon with the existence of an endowment effect due to loss aversion. Therefore, an individual will demand more compensation to accept a loss of a good than he was or would be willing to pay to obtain the same good (KAHNEMANN et al., 1991). For the case of SURUMER, the "willingness-to-accept" (WTA) basically refers to the acceptance of forgone income for providing ecosystem services at farm level and is usually expressed in monetary terms.

We think that this purely economic perspective does not completely reflect the complex reality of decision-making and therefore follow a more holistic behavioural approach, whereby we define "willingness" - in a change concept - as a synonym for "motivation" in social-psychological concepts: Willingness to accept changes towards more sustainable rubber cultivation refers to sustainable land-use change and management at the regional level; it differs between stakeholder groups according to their interests (farmers: livelihood, forgone income; politicians: ESS, societal problems).

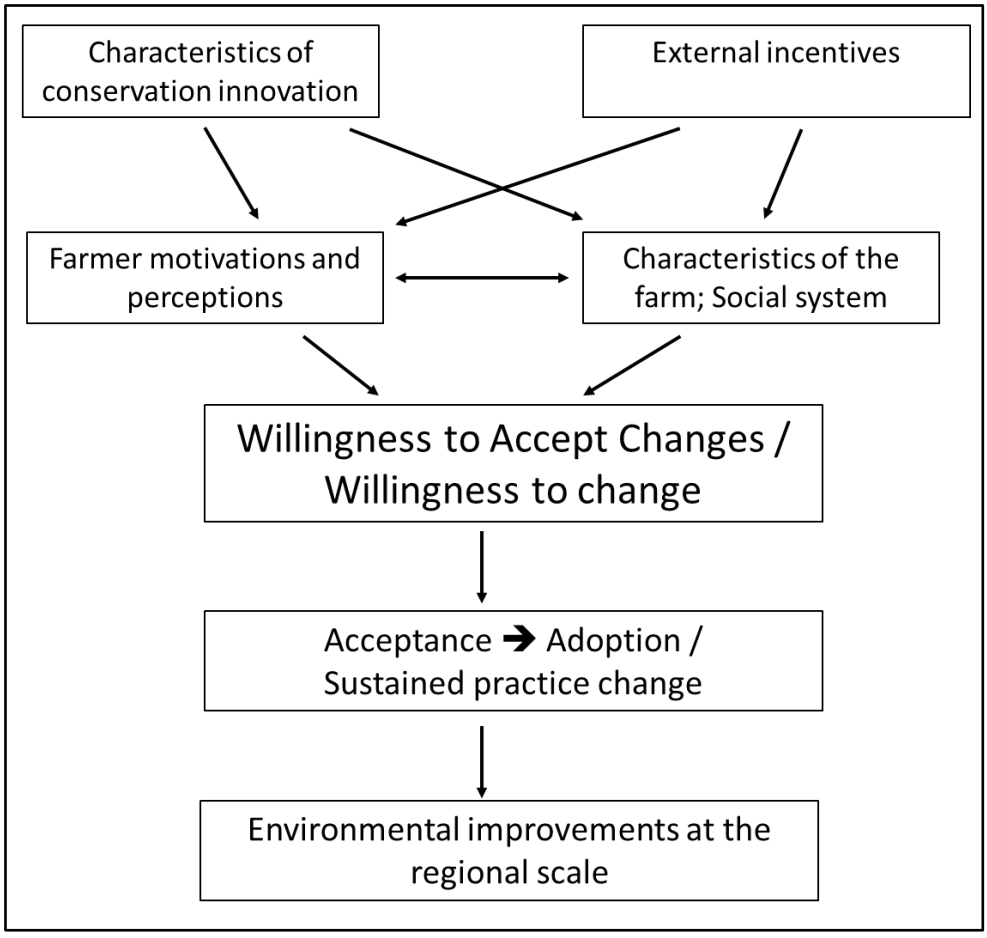
Behavioural approaches seek to understand behaviour of stakeholders including land-owners or farmers with a focus on psychological constructs such as attitudes, values, goals as well as other relevant external factors considering the social or economic circumstances (BURTON, 2004). HOFFMANN et al. (2009, 55) follow Kurt LEWIN (1951) when they argue: "*Behavior is a function of the interaction of the individual and his perceived environment. It is not the totality of factors in his environment that influences his behavior but only those which are perceived by the individual ... Not only current information but also knowledge drawn from the past, in other words experience, and the anticipation of future events, in other words expectations, contribute to the subjective perception of circumstances.*" Consequently, human perception is an *"... individual and subjective process that differs from person to person. And no person could have a memory identical to someone else; this again confirms that perception is individually shaped*" (ibid.). Behavioural change is multifactorial, as there is *"... no one single cause of human behavior; it results from the interplay of diverse factors*

which create a set of circumstances through the dynamic interaction between man and his environment" (ibid.).

2.2 Conceptual framework

Land use changes are always effects of changes in individual behavior: farmers first change their motivation or "willingness", either to accept externally generated knowledge on changes or to introduce changes themselves before they change a certain crop or cultivation method (Figure 1). Changes can be introduced by the farmers themselves or externally, and thus *willingness to accept changes* (WTA) and *willingness to change* (WTC) are seen as complementary, two sides of a medal.

Figure 1: Conceptual framework of willingness to accept and willingness to change

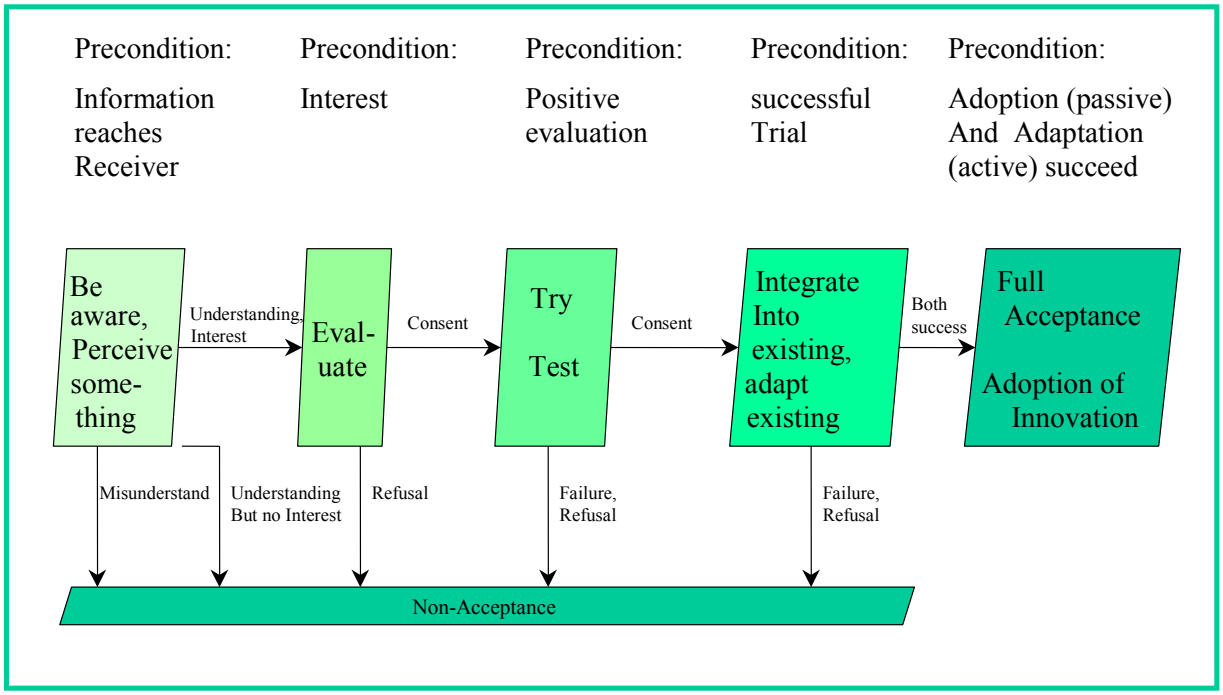


Source: GREINER & GREGG 2011, modified

Looking at diffusion processes of innovations (ROGERS 2003) from the point of view of an individual, acceptance can be seen as a process of decisions in which acceptance increases or

decreases, depending on succes or failure of the previous step (Figure 2). Full acceptance, which is expressed by the adoption of an innovation or self-introduced "practice change", will happen, if an individual farmer has been aware of the innovation, understands it, is interested (has a positive attitude) and positively evaluated it, tested it and thus integrated it to a certain extent into his/her existing production system (which usually requires adaptation).

Figure 2: Process of Acceptance



Source: PRAGER 2002, translated

Factors influencing WTA and WTC are (amongst others) related to the innovation, external incentives, the characteristic of the farm, and first and foremost factors farmers' intrinsic motivation and perception (figure 1).

With respect to the **characteristics of the innovation**, their attributes as perceived by the farmer are seen as important (ROGERS 2003). Perceived attributes of the innovation are:

- Relative advantage: The degree to which an innovation is perceived better than the idea it supersedes;
- Compatibility: the degree to which an innovation is perceived as consistent with the existing values, past experience and needs of potential adopters;
- Complexity: The degree to which an innovation is perceived as relatively difficult to understand and to use;

- Trialability: The degree to which an innovation may be experimented at a limited basis (field level) or adopted in stages;
- Observability: The degree to which observers are able to see the results of an innovation.

External incentives depend on framework conditions. Economic factors such as price relations, policies, institutions certainly play an important role, as well as the transfer of external knowledge for example through extension and education. This includes the communication channels, the means by which messages are passed from sender to receiver(s) (ROGERS 2003).

Characteristics of the farm respectively the farming system are closely related to the surrounding **social system**, its rules and norms as well as interconnectedness amongst the social network.

The above-mentioned three aspects are extrinsic factors of WTA/WTC. **Intrinsic motivation** "*...refers to doing something because it is inherently interesting*" (RYAN and DECI 2000). It can be rational or irrational, conscious or unconscious.Intrinsic motivators such as cultural aspects, "value" of environment etc. are seen as a key aspect of WTA/WTC. It is influenced by the personal perception of the problem and the solutions' gains and potential losses. One of the intrinsic motivators is risk perception as the latter comprises measurable and immeasurable uncertainty, personal evaluation of potential consequences and individual risk preferences (GRAINER et al., 2009).

Table 1 gives an overview on possible factors regarding farmers' acceptance of change towards susainable rubber cultivation in Xishuangbanna, to be analysed within the study.

Table 1: Hypothetical factors influencing farmers' acceptance of change

Innovation	External incentives		Farming / social system		(intrinsic) Motivation factors
	Economic / factors	Knowledge transfer	Farming factors	Social factors	
• Relative advantage • Compatibility • Complexity • Trialability • Observability	• Rubber price • Income • Social cost, externalities • Opportunity cost • Compensation • Instituions • Governmental support • Taxes • Legislation	• Innovation Channels • Duration until success • Knowledge about future changes • Persuasion • Way of advising	• Farm size • Intercropping potential • Age of the plantation • Knowledge on traditional land use • Understan-ding and valuation of ecology	• Traditions • Rules and norms • Appreciation by society • Collective action • Intercon-nection within the community	• World views • Beliefs • Moral norms • Awareness of need, • Perceived consequen-ces, • Responsibility • Social and behavioural norms

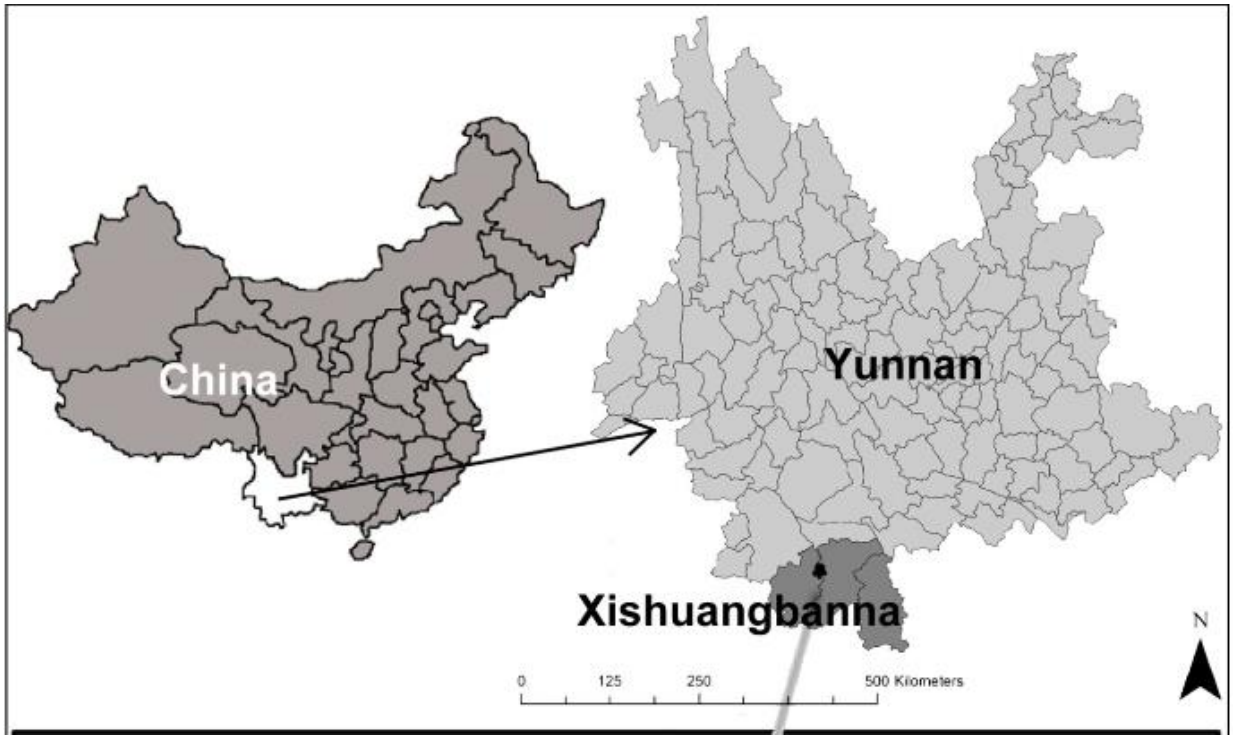
3 Methodology

A qualitative case-study approach has been chosen. Qualitative research follows an interpretive paradigm which assumes that knowledge is coming from human experiences and that reality is a social construct. Understanding this reality is the aim of the interpretive researcher. The research outcome is based on previous knowledge and beliefs of the researcher which guide them and lead to certain insights (HATHAWAY, 1995). The study was implemented by an interdiscilinary team in form of a student project at Humboldt-Universität zu Berlin (cf. HOFMANN-SOUKI et al. 2014).

3.1 Research Area: The NaBan River Watershed National Nature Reserve

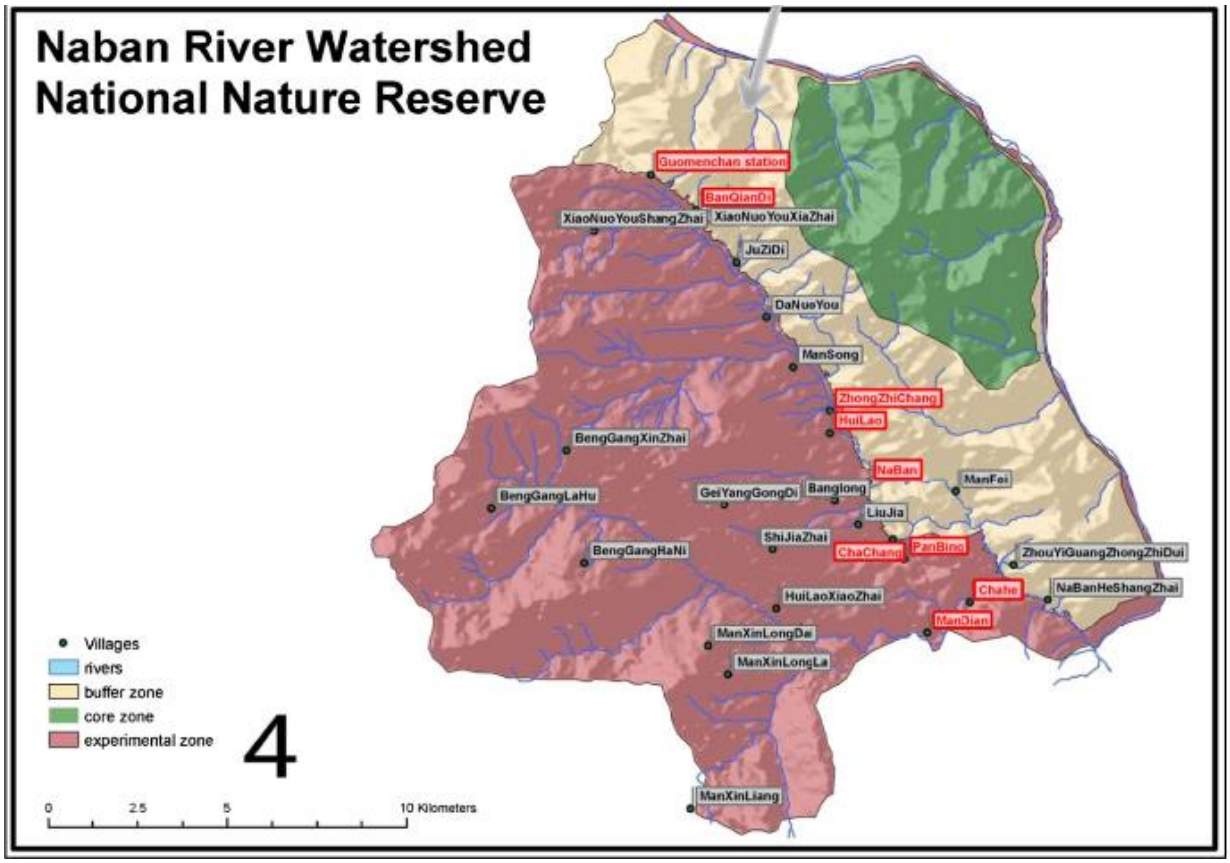
This study was conducted in the NaBan River Watershed National Nature Reserve (NRWNNR), in the northern part of Xishuangbanna Autonomous Prefecture of Yunnan Province in South China (Figures 3 and 4).

Figure 3: Location of the NaBan River Watershed National Nature Reserve (NRWNNR)



Source: GHORBANI et al., 2012

Figure 4: Map of the the NaBan River Watershed National Nature Reserve



Source: GHORBANI et al., 2012

Geography and Environment

The southern Yunnan Province is in the boundary area between China, Burma (Myanmar) and Laos. The NaBan National Nature Reserve comprises an area of ~ 260 km^2 with mountains reaching elevations between 474 up to 2429 meters above sea level. Accordingly, the terrain is very steep and in 80% of the area the gradient is more than 25 degrees. The annual temperature of the catchment area ranges between 18-22 °C with an average rainfall of 1100-1600 mm mainly during the rainy season from May to October. Soil conditions are mainly controlled by altitude, precipitation and human influence. Above 1500 meters red and yellow soil types are dominant, whereas below 800 meters brick-red soil can be found (AENIS et al. 2014; WEHNER, 2011).

Even though human influence on the environment increased over the last decades, Xishuangbanna is still perceived as a biodiversity hotspot. Eight different vegetation types provide a habitat for 437 species (alone 269 different bird species) and some of those species can only be found in this area and are threatened with extinction. In order to maintain the species diversity in Xishuangbanna, the NRWNNR was established in 1991 with the NaBan

River basin as the initial point. The protection area is based on the UNESCO "Man and the Biosphere" concept and the territory is divided into three different zones:

- A core zone (green), in which human land use is prohibited and where most of the natural rainforest is located;
- An experimental zone (red) where most of the villages are located and agricultural activities prevail. Most activities except for large construction sites are permitted;
- A buffer zone (yellow), which lies between the green and red zone where research and certain interventions are permitted for local villagers.

Social Characteristics

The state owns 74 % of the total area of the NRWNNR, e.g. rivers and mountainous forest land, especially in the core zone. About 26 % of the land area is collectively owned which also contains a high share of natural forest coverage (60%).

In 2004, a total of 32 natural villages in the NRWNNR was inhabited by 5,566 residents with a mean of 40 households per village. Each natural village belongs to one of the five administrative villages ManDian, DaAn, BengGan, DaNuoYou, and NaBan, which lie in one of the two counties Menghai and Jinghong. The villages differ greatly in term of size, population density, income and social conditions. One of the factors that is similar in all villages is the household size: 4.3 people on average. The per capita income per year was about 1,794 RMB in 2004. The main income source is agricultural production. The composition of income has changed substantially during the last decades. TANG (2013: p.55) states that *"... although all are situated in the NRWNNR, different villages have different agricultural industries because different towns and villages possess different policies, capabilities and administrative interventions to develop agricultural industries"*. The access to infrastructure and telecommunication is often limited, especially for transportation during the rainy season. Eight primary schools in the NRWNNR are responsible for basic formal education.

Xishuangbanna is home to a large number of ethnic minority groups. The largest of the six ethic groups in the NRWNNR is Lahu (50.34%), followed by Hani (23.37%), Dai (11.37%), Han (10.22%), Yi (3.34%) and Bulang (1.35%). According to WEHNER (2011) there is a close connection between belonging to an ethnic group and the traditional land use. Thus, Dai are traditionally known as rice farmers and Lahu as shifting cultivators, hunters and gatherers. Other groups have practiced a mix of both land-use types. Han migrated into the region in the first part of the 20th century as a result of persecution and adopted the cultivation practices from surrounding villages.

Some communities have been resettled and villagers have been migrating during the last 50 years due to political, infrastructural, and economic internal and external influences and forces and external aspects of nature conservation. Therefore, only few of the 32 villages

have been existent in the region for a longer period of time. The oldest settlements may have been founded 500 years ago. Influence of humans on the environment has increased in the last decades as a result of migration, population growth, and modified land use systems (Tang et al. 2009, Tang 2013, Wehner 2011).

The research has been conducted in 6 villages: ManLu/KeMu, PanBing, ChaChang, NaBan, ManDian and ZhanZhiZhan. The first five villages mainly depend on rubber for their income generation while ZhanZhiZhan depends on rubber only to some extent, and they were found to have rather diversified income sources. In order to have an idea about the location, the six villages of the case study will be introduced shortly, following AENIS at al. 2014. These are the same villages as those visited in the previos study because the current study can be seen as a logical next step after the identification of stakeholders and because these are the villages in which stable contacts with village heads have been established by the NRWNNR.

ManLu/KeMu

ManLu/KeMu village was established in 1982. The population is represented by 22 households with 105 people who mostly belong to the ManLu/KeMu ethnicity. Rubber is cultivated on 2420 mu and the mean annual income per person is 6,700 RMB, which makes ManLu/KeMu the richest village of the whole research area. The first rubber trees were cultivated in 1984, when the government required each household to cultivate at least 1 mu. Additionally, the villagers have been cultivating Dendrobe since 2009 (Village head). The communal land was created for non-agricultural use in order to protect water, common traditions and to use it as a wood resource. Nowadays, the village is surrounded by a state farm, which also offers trainings and seedlings.

PanBing

PanBing village consists of three parts. It is around 30 to 40 years old and was moved twice from its original location. Initially, the village was located close to Menghai but the area was determined to be the NRWNNR's core zone. As a senior farmer said: "*In 1966 the government moved the village to another location. But access to transportation and infrastructure in the second location were insufficient in 1975, and the village was moved to the present location.*" The village consists of 42 households and one village community house (for meetings and dances). In total, 163 people live in PanBing mostly belonging to the Hanethnicity. They have an annual income of about 6,500 RMB, making it the second richest village in the research area. There is a communal land area, but it is forbidden to cut down trees due to NRWNNR regulations. Most of the people have livestock and grow vegetables for subsistence such as pumpkin, carrots, cabbage. All farmers in PanBing were found to plant rubber, however not all 41 are tapping. 100 mu is the biggest area of rubber plantation (Village head and NRWNNR official) in PanBing.

ChaChang

ChaChang lies at an altitude of 750m and was established around 35 years ago. It is inhabited by Lahu people and it used to be a tea producing village. However, tea is not cultivated anymore. There are 29 households and a total population of 91 inhabitants. Rubber is currently cultivated on 735 mu and the average income per person per year is 5,710 RMB.

NaBan

NaBan village is around 500 years old (Village head). It is located at an altitude of 690m and consists of 42 households. The majority of inhabitants belong to the Dai ethnic group, with some Han Chinese and Lahu. Rubber is cultivated on 780 mu. The average annual income is 4,970 RMB. NaBan village is very rich in flat lands, so the main part of it has been cultivated with rubber already.

ManDian

ManDian village is set up by 67 households with 288 inhabitants. ManDian is the most populated of all researched villages and people belong to the Dai ethnic group. Rubber is cultivated on 2098 mu and the mean income per person and year lies at 4,900 RMB. With an average altitude of 670m, ManDian is suitable for planting rubber. According to the village head, rubber cultivation in ManDian began in 1984, inspired by the ManDian-State farm, which was founded in 1982. Consequently, the mountainous lands are all cultivated with rubber trees so that some villagers are renting land from outside to plant even more rubber. Additionally, the village also cultivates 12 mu of dendrobe.

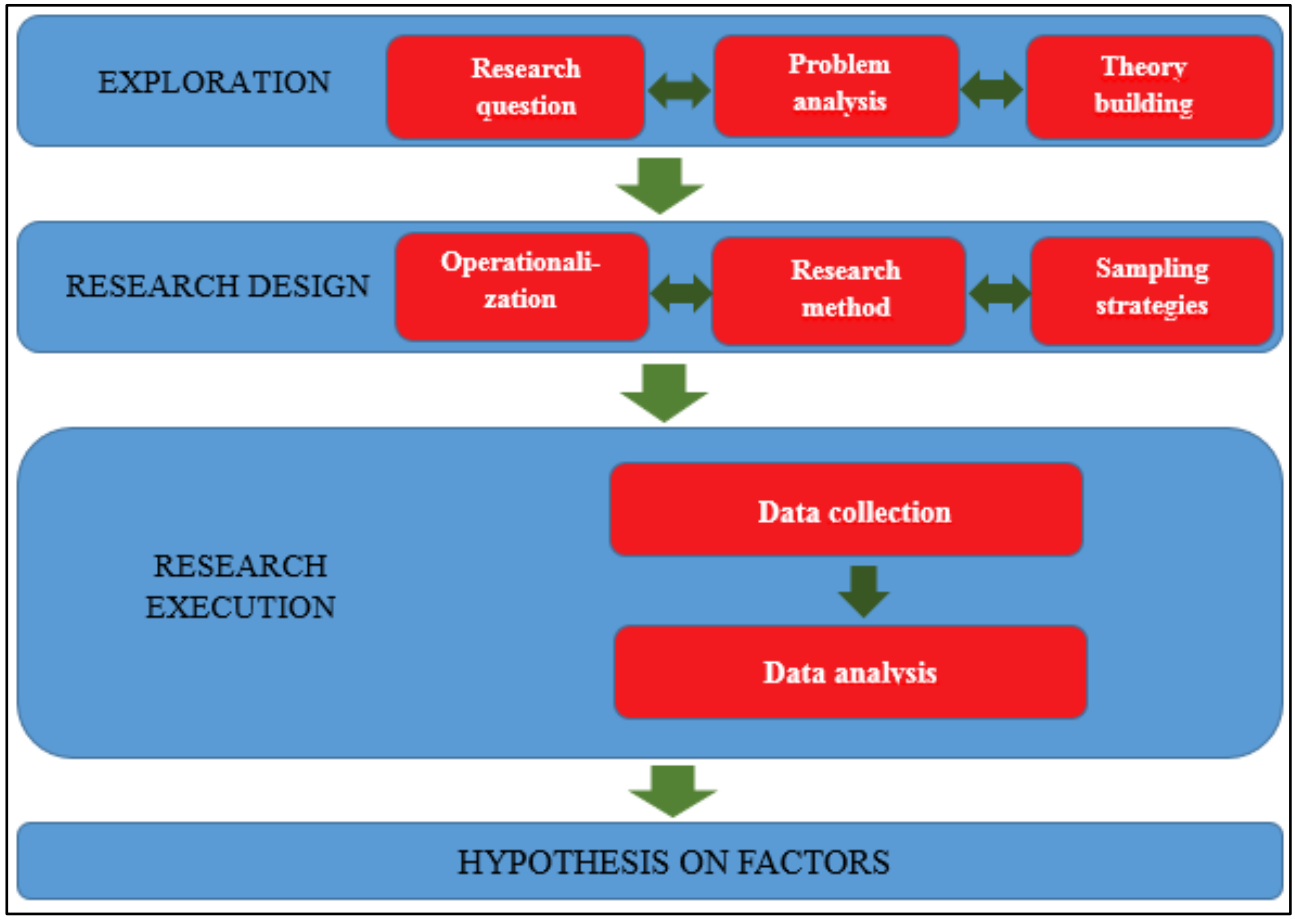
ZhanZhiZhan

ZhanZhiZhan is a natural village which lies at an altitude of around 700 m and belongs to DaNuoYou. The people living in ZhanZhiZhan mainly belong to the Han ethnicity and were resettled from the mountainous Dabonggang in 1984, as their old lands were in the area of NRWNNR's experimental zone. It is comprised by 22 households and villagers have been cultivating rubber since 1987. Living standards are fairly high with a mean annual income of around 3,514 RMB per person. Nowadays, all households plant rubber trees which also take the main share in terms of land use. Ten households were found to be renting land from outside the village, namely from Huilao and DaNuoYou Village. The renting schemes are set up for a period of up to 50 years (Village head).

3.2 Research process

Phases and steps of the research process are shown in Figure 5. The iterative process consists of four phases: an exploration phase, a data collection phase and a data analysis phase and a final model building phase.

Figure 5: Research process



Source: Bhattarcherjee 2012, modified

Exploration

Exploration included recherche and analysis of basic literature on the topics and the study region. Furthermore, discussions about the topic, possible research questions, a preliminary problem analysis as well as first theoretical considerations on willingness to accept and willingness to change. Based on findings available from the SURUMER project the group focused during the *problem analysis* mostly on environmental problems initiated by the cultivation of rubber. Leading questions were:

- What kind of changes?
- What is sustainable rubber cultivation?
- How do innovations typically spread?

Research design

The research design can be defined as a "*comprehensive plan for data collection in an empirical research project*" (Bhattacherjee, 2012). Generally spoken a research design should be chosen regarding the phenomenon studied as well as the abilities and resources of the researcher. It should allow to collect as much and as diverse data as possible in order to get the best possible insights (ibid.).

Operationalisation is the process of "*designing precise measure for abstract theoretical constructs*" (BHATTACHERJEE, 2012). This is of specific difficulty as the concepts of willingness, acceptance and motivation are hard to define and not clearly measurable. Therefore, factors which could have an either negative or positive influence on the willingness to accept land-use change were drawn from several theories from the fields of (institutional) economics, philosophy, psychology and practical examples.

Research method is a multiple case study approach, a type of social science research which allows for in-depth, exemplary investigation *"... in one or more real-life settings (case sites) over an extended period of time"* (BHATTACHERJEE, 2012). It allows for using a wide variety of methods, in this case semi-structured interviews, observations and focus group discussions. The advantage of case study research lies in its ability to detect various factors (social, cultural, political) which may have importance for the research topic and which are not necessarily known in advance. Therefore case study research can be used for theory testing as well as theory building (ibid.). In order to show a variety of willingness to accept and thus a range of factors and, hopefully their priorities, two cases were selected (see chapter 5):

- One case where a relatively high level of willingness to accept changes could be expected, namely water protection which improves drinking water quality;
- One case with a low level of acceptance to be expected: intercropping of rubber with other plants.

Sampling strategy was a purposive selection of interview partners in six villages in the NaBan River Watershed National Natural Reserve. The same villages were chosen as in a preliminary study (AENIS et al. 2014) in order to allow for direct comparison. The respondents were selected either through suggestion of the village head or by NRWNNR staff members who accompanied the interviewers, organised accomodation and food in the villages, and helped the team as translators.

Research execution

Semi-structured interviews, Focus group discussion, and observation were chosen as **survey methods**:

- As described by DUNN (2005), interviews are verbal interchanges where the researcher and the interviewee attempt to elicit information from one another. The form of semi-structured interviews have some degree of predetermined order, but still ensures flexibility in the way issues are addressed by the interviewee (LONGHURST, 2003:105). The highlights on the interview guideline may be series of open-ended questions or they may simply general topics. Semi-structured interviews are more targeted than unstructured interviews, but more flexible than questionnaires (NEWING, 2010:101).
- Focus groups are a form of group interview that relies on communication between research participants in order to generate data. Focus groups can consist of 6 participants or more, depending on the purpose of the study as well as the available resources. This sort of interview enables participants to talk to one another, asking questions, exchanging anecdotes and commenting to each other's experiences and points of view (KITZINGER, 1995). Spontaneity is the main feature of focus groups in response to their strong social context. Therefore, their perspective is less influenced by the interaction with the researcher than it might be in a one-to-one interview practice. The group participants may take over the role of interviewer, and the researcher is at times more in the position of listening to (RITCHIE and LEWIS, 2013).
- According to NAMEY et al. (2005) participant observation can help the researcher to not only understand data collected through other methods such as interviews, but also to design questions for those methods that will give a better understanding of the phenomenon being studied.

The data collection took place in March 2015. All in all 35 interviews have been carried out (Table 2, for interview guidelines see annex). A focus group discussion was carried with the leaders of three villages in which interviews have been conducted (ManLu/KeMu, PanBing and NaBan) at the end of the field-research. During field-research the students stayed in the villages, where interviews were conducted. The village members shared their homes with great hospitality and included the study groups in their social activities and showed them around the villages. Of course, thereby certain observations – of participatory as well as non-participatory nature – were made. Although they were not conducted in a structured manner they had an influence on the research, the perception of problems, the ranking of factors as well as the model building and allowed to crosscheck interviews.

Table 2: Overview of interviews conducted

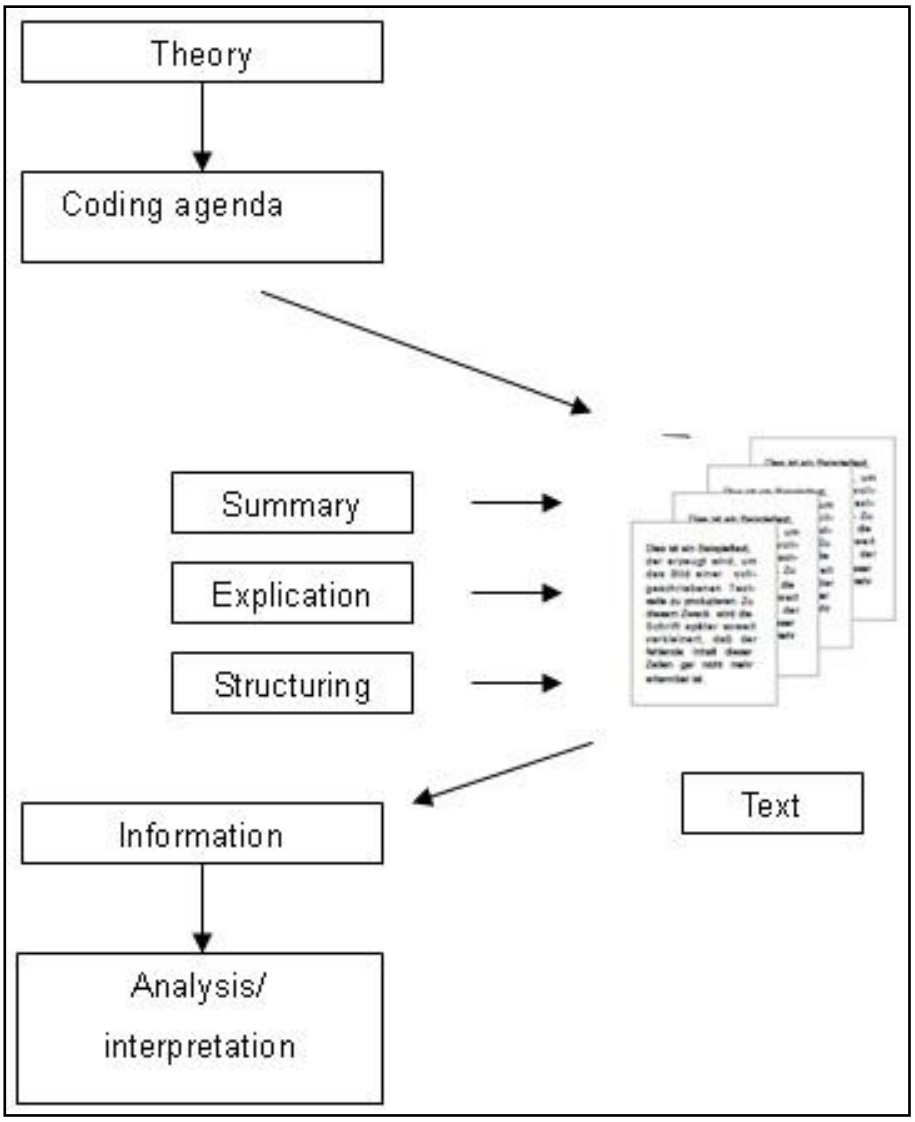
Village	Sex		Function					No
	M	F	Rubber Farmers	Village Head	Hired Workers	Women Leader	Party Leader	
PanBing	7	-	5	1	1	-	-	7
NaBan	4	2	6	-	-	-	-	6
ChaChang	4	2	5	-	-	1	-	6
ManDian	4	2	5	1	-	-	-	6
ZhanZhiZhan	3	1	2	1	-	1	-	4
ManLu/KeMu	5	1	5	-	-	-	1	6
Total	27	8	27	3	1	2	1	35

It was obvious that not all farmers would be familiar with the new technologies, neither with intercropping nor with water protection zones. They might use similar techniques but name them different, they could implement them in different ways, only partially, or they could have no experience with the techniques at all. Therefore it was decided to firstly give some information on SURUMER and introduce the two cases. Before the field phase two posters (cf. annex) were produced which show the concepts of intercropping and water protection zones using pictures and short and (hopefully) easy-to-understand explanations in Chinese language. These posters proved to be good instruments to directly approach the farmers and helped the researchers to not only talk about those things in a theoretical way but provide concrete examples.

Qualitative content analysis aims to preserve the information generated during the study, transfer and further develop them to qualitative-interpretative steps of analysis. The genereic process is shown in Figure 6. BECKER and LISSMANN (1973) have differentiated levels of content: themes and main ideas of the text as primary content; context information as latent content. Content analysis embeds the text into a model of communication within which it defines the aims of the analysis. KRIPPENDORFF (1969) further defined content analysis as "*the use of replicable and valid method for making specific inferences from text to other states or properties of its source"* (MAYRING, 2000).

Coding is the initial phase to perform qualitative content analysis. Therefore, coding is a method that enables us to organise and group similarly coded data into categories or "families" because they share some characteristics-the beginning of a pattern (SALDANA, 2009:8). Therefore, in our research study, coding and categorisation was used towards analysis and interpretation for the report. Categorization was developed from the research beginning, and afterwards generated from the interview results.

Figure 6: Process of qualitative content analysis



(Source: KOHLBACHER, 2006 based on GLASER & LAUDEL, 1999)

Four main categories were defined for this research:

1. Category I: The value of rubber cultivation
2. Category II: Problems perceived by the farmers
3. Category III: Factors of acceptance
4. Category IV: Attitude towards change

Furthermore, relevant statements from the interview transcripts were inserted into the appropriate code. Based on the code and category, the analysis of the result is carried out to develop the holistic concepts toward acceptance of change.

4 Introduction to the case studies

4.1 Water Protection

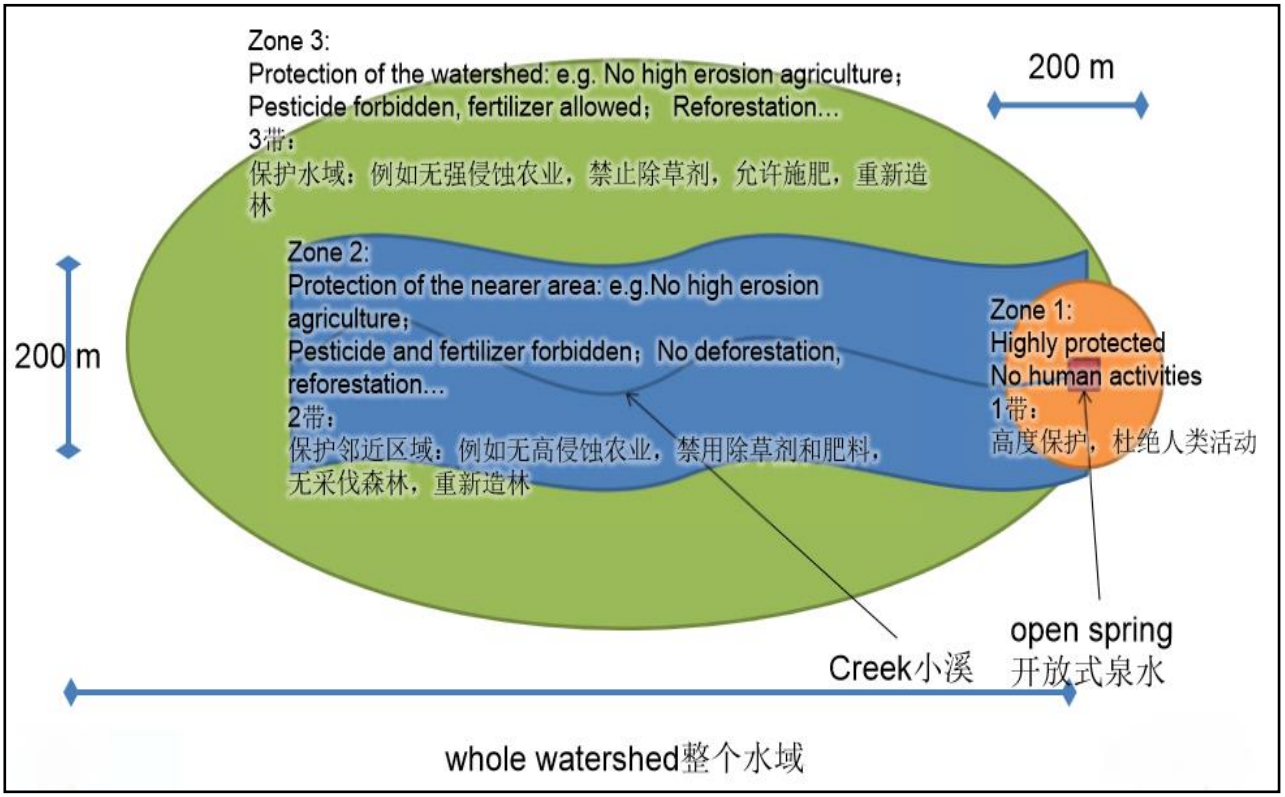
Water protection in this case is implementing a water protection zone around the water source/spring of each village in order to increase the water quality/quantity. In general "*a water-protection zone is a territory that borders upon water area of rivers, lakes, reservoirs, and other surface bodies of water, and a special regime for economic and other operations are enforced in a water protection zone, in order to prevent pollution, contamination, siltation and depletion of the bodies of water and to preserve critical habitats*" (Galinovskaya,1997)

Picture 1: The water collection point of the village ManDian

Water would be protected by establishing three different sectors: The core zone embeds the water spring and is highly protected, with the aim of prohibiting all human activities to ensure no direct pollution next to the water spring. The second zone allows low impact agriculture, but without usage of agrochemicals. This zone is larger than the core zone and aims in stopping deforestation to decrease soil erosion. The third zone covers the largest area

around the water source. In this zone, high erosion agriculture is restricted as well, but usage of fertilizer is allowed.

Figure 7: Technical drawing of a Water-Protection-Zone



Source: KRAUSS 2016 (draft version, modified and translated)

Possible benefits of implementing a water protection zone are:

- Prevention of water pollutions and no need to eliminate the consequences of the water pollution via complicated and expensive water treatment technologies.
- Water can be cleaned by physical, chemical, microbiological processes in the ground.
- Erosion is reduced, with it pesticides and microorganisms/pathogens are attached to particles.
- Clean water sources for the region and farmers are maintained.

In order to reach a successful implementation of the water protection zone, the following points are important:

In order to establish the technology:

- Consensus building on the necessity of the water protection zone among farmers is necessary.
- Responsibilities for the water protection zone need to be clearly defined.
- Critical farming activities should be identified before implementing the water protection zone.
- Compensation should be given to farmers who are negatively affected by the water protection zone.
- A clear boundary of the water protection zone is necessary, and all the farmers need to be informed about it.

In order to maintain the technology:

- Continuous consensus building in the local community on the necessity of the water protection zone is necessary.
- Monitoring and sanctioning processes are needed to control the activities in the area.
- Improvement of water quality needs to be researched after the implementation of the water protection zone, and the information should be given to farmers regularly.

4.2 Intercropping with trees and bushes

The second of the two concrete cases drawn to analyse the factors influencing farmers' willingness to grow "greener" rubber was concerned with agro-ecological diversification by intercropping with trees and bushes. Intercropping implies growing two or more species in close proximity as shown on the example picture 3. In the framework of SURUMER, intercropping deals with planting other species between rubber trees in the rubber planation in order to attempt to increase biodiversity or gain further benefits, like stabilization and fertilization of soil. Depending on the alternative crop, the size and the age of the existing rubber plantation, the density of introduced intercropping plants would vary.

Picture 2: Cassava intercropped with rubber, Kampon Cham, Cambodia

Source: Wikimedia Commons

The objective is to promote agro-biodiversity and crop diversification in rubber-dominated land-use systems and to increase the capacity and awareness of different stakeholders, in particular farmers, rural communities, agricultural authorities and institutions, to sustainably manage and use agro-biodiversity in rubber-based plantations. Specifically, indigenous species, crops, varieties (such as wild vegetables, medicinal plants, food crops) are identified for their suitability for cultivation in rubber plantations of different ages (i.e. different ecological conditions) and generate added value for farmers. Based on this, concepts for agro-biodiversity management in rubber dominated land-use systems are developed. The results can be promulgated and extended to government extension service to promote the diversification of rubber dominated land-use systems (SURUMER SP5, 2014).

For the farmers the intercropping approach could be of interest, because it is attempting to combine rubber production with additional benefits, such as a long-term income option beyond rubber and improved ecological value without compromising income.

The plants suitable for agro-ecological diversification should have an economical potential and long-term usability, should be perennial crops to avoid regular soil disturbance, should require low labor input, should be native to China and posses conservation values, in other words be rare or protected species. Three species have been selected:

Taxus Yunnanensis (wallichiana) or Himalayan Yew

Taxus yunnanensis is a small to large understorey or lower canopy treeplantwith the growth distribution from Nepal to Sumatera. Himalyan Yew reaches maturity after 3-5 years. The expected benefits are a short-term income option due to medicinal properties. The bark of the plant contains alkaloid compounds (taxanes) which are used for production of the anti-cancer drug “paclitaxel” (Taxol®). The leaves yield similar compounds in lower concentrations. The long-term economic benefits can be derived from wood usage, since the timber is durable and strong and can be used for door frames, furniture and smaller wood works. (IUCN, 2015)

Picture 3: Taxus Yunnanensis

Sources: Langenberger (left), Chinese Field Herbarium (right)

Parashorea chinensis

Parashorea chinensis is an emergent tree, in primary forest areas reaching heights of 80 m. It is native to China (Guangxi, Yunnan) and Viet Nam. In China only a few large trees are left, the Yunnan sub-population being restricted to an area of 20 km². The plant is classified as 'Endangered' in the IUCN Red List of Threatened Species 2015 (IUCN, 2015). The long-term benefit of the tree is its valuable timber, which can be harvest probably after 15-30 years. The brownish-yellow wood is fine-grained, hard, heavy, durable and resistant against termite attack. The excellent wood is used for construction and making furniture (Flora of China, 1994)

Picture 4: Parashorea chinensis

Source: Langenberger (left), Chinese Field Herbarium (right)

This very rare species is endemic to Jinghong County in the Xishuangbanna Prefecture. It occurs infrequently as a component of the upper canopy of monsoon forest between 540 and 850 m. Logging has contributed significantly to the decline in the extent of the species' rang protection and has acquired the status “Critically Endangered”. The heavy wood can be used as commercial timber in construction and furniture production (DE-YUAN HONG, BLACKMORE, 2015)

Nyssa yunnanesis

Picture 5: Nyssa Yunnanensis

Source: Langenberger (left), Chinese Field Herbarium (right)

Flemingia Macrophylla

Flemingia macrophylla is a perennial, deep-rooting, leafy shrub reaching up to 3 m, naturally occurring in southern China, Taiwan, India and Sri Lanka. It can be used in wide variety of ways: for erosion control, as mulching and green manure biomass, as shade trees for young coffee and cocoa seedlings, as a cover plant for weed suppression and soil enrichment (since it is a legume), as support for climbing crop species, as a medicinal plant, an in a number of other ways (Budelman&Siregar, 1997). Flemingia has not been specifically chosen by the SURUMER scientist, but has been a natural subject matter of the interviews, because of the governmental focus on Flemingia as a possible intercrop. The NRWNNRB has supported flemingia adoption by farmers through subsidies, giving out free seedlings and extension services.

Picture 6: Flemingia macrophylla

Source: Langenberger (left), Chinese Field Herbarium (right)

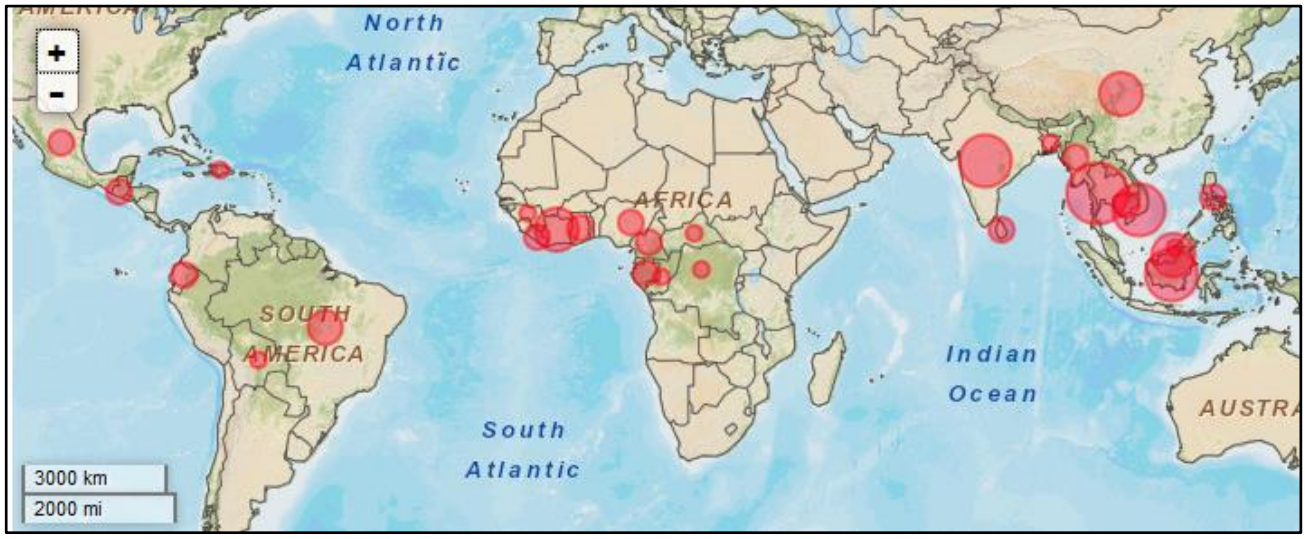
When dealing with the above-mentioned crops the following management assumptions and expected benefits have been taken into consideration: If the intercrops are established in middle-aged rubber plantations (ca. 15 years), new plants are not expected to affect rubber yields and no weeding is required due to shade, thus ensuring a cost efficient planting. At end of rubber cycle (ca. 30 years) a new land-use matrix will be established, providing options for further development of the systems, e.g. through additional integration of high-value crops.

5 Rubber production in Xishuangbanna and its value for farmers

5.1 Overview on rubber cultivation

Caoutchouc or natural rubber is an indispensable raw material in the global production of a great number of commodities ranging from tires to medical gloves and many more. While about 54 % of rubber produced today is synthetic rubber, some of the unique properties of natural rubber cannot be substituted by its chemical counterpart. Therefore, 46 % continue to be obtained from the milk of the rubber tree, Hevea brasiliensis. (WDK, 2008; INTERNATIONAL RUBBER STUDY GROUP, 2013). The rubber tree can be cultivated within the so called "rubber belt" between 30° northern latitude and 30° southern latitude, where its climate and soil demands are met (WDK, 2008). Today, 91.5 % of the global production of natural rubber is realised in Asian countries. The remaining world production is realised by African countries (5.2 %), South American countries (3.2 %) and to a very small extend by Oceania (0.1 %) (FAOSTAT, 2013). The places of production worldwide are shown in Figure 2. While demand in rubber continues to grow, world demand is expected to grow at a slower pace than world supply in 2015 and 2016. The reason for this being in particular the slow-down of consumption growth in China, the biggest importer of natural rubber (BLOOMBERG, 2015).

Figure 8: Natural rubber – production quantities by country, 2013



Source: FAOSTAT, 2013

In 2013, the 5 biggest producers of rubber were all located in Asia. Reasons for this include the good adaptation of rubber trees to the local tropical climate, the availability of cheap labour and the willingness of people to adapt their lifestyle to the special needs of rubber cultivation, such as harvesting during the night. The biggest producer was Thailand (2013: 3,863,000 tonnes), followed by Indonesia (2013: 3,107,544 tonnes), Viet Nam (2013:

949,100 tonnes), India (2013: 900,000 tonnes) and South-West China (2013: 864,806 tonnes).

In China, areas suitable for rubber cultivation are found only in the South-West of the country. The rapid development of rubber cultivation in this area was initiated by political actions and is today driven by economic conditions of the rubber world market. LU and LIN (2010) give an detailed overview on the history of rubber cultivation in China. They explain that during the 1950s the Chinese government aimed to achieve self-sufficiency in rubber production as a response to a trade embargo imposed on key industrial goods during the Korean War. In this way China aimed to satisfy its rubber demand for the military as well as for industrial production. State-owned farms were established in the regions Guangdong, Hainan Island and Yunnan. Farmers as well as extension workers and intellectuals from other provinces were sent to these regions to help establish the state farms and organise the different steps of production from growing the trees, over tapping and processing the liquid rubber. In the 1960s new high-yield varieties were planted which increased the average output from 1.5 kg per tree to 4 kg per tree, leading to a significant rise in total production output. The ownership reform and subsidy supports of the 1980s led to the dissemination of many state farms into smallholder private farms. Formerly collectively owned land could be transferred to individual households through long-term leases. Monetary subsidies ended in 1990. However, farmers by then were granted the permission to freely access the market of rubber as opposed to having to hand over the rubber to state corporations which used to sell the rubber and distribute profits between all farmers. This change in policy gave new incentives to rubber cultivation. While technical support to private farmers was and is still providedby state farms, the speed of the expansion of rubber thereafter depended mainly on the market (LU & LIN, 2010).

In Xishuangbanna, first trials of planting rubber trees were conducted by a Chinese settler coming back from Thailand in 1940 (TANG et al., 2009). During this time Xishuangbanna was an independent feudal kingdom maintaining close relationships with Burma, Thailand and Laos. The valleys of Xishuangbanna were populated by the ethinc group of Dai Lue, predominantly cultivating paddy rice, while the mountaineous area was cultivated by other ethnic groups, living from hunting and gathering as well as shifting cultivation. The kingdom had a very low density of population on the one hand and plenty of forest and land as well as strict institutions governing land use on the other hand, allowing for a sustainable use of natural ressources. Only in 1950 Xishuangbanna became part of China and local farmers had to give up their traditional practices, which were partly replaced by new Maoist regulations and technologies (WEHNER, 2010). The first state rubber farm of Xishuangbanna was founded in 1955 and further state farms followed in the 1960s in line with the efforts of the government to increase Chinese rubber production. In addition, rubber cultivation was seen as a good way to integrate local minorities into the Chinese nation state and modernize their cultivation techniques. In 1963, first local farmers started to cultivate rubber and with the incentives set by the government during the 1980s many young people started to cultivate this cash crop. Xishuangbanna developed to the second largest producer of rubber in China, after Hainan Island (TANG et al. 2009). This development was accompanied by a large growth in population through immigration and natural growth from 10 persons to 50 persons

per km² and by an immense reduction of natural forest in Xishuangbanna (WEHNER, 2010). Due to political support and growing demand over the last decades, the accumulated area of rubber tree plantations in Xishuangbanna, Yunnan, had risen from 0 Chinese mu[1] in 1950 to 3 million Chinese mu (200.000 ha) in 2010 and accounted for 35 % of China's total rubber production (LU & LIN, 2010).

5.2 The value of rubber cultivation for farmers

Rubber cultivation had and continues to have a big impact on farmers' livelihood: The main influencing factors identified during the interviews are income, lifestyle and transmission of heritage.

Income

The interviews have clearly underscored the importance of rubber as the main income source for most of the farmers. Practically all the farmers have often mentioned income as the primary motivation to plant rubber which clearly makes this reason for cultivation the most prominent. Numerous farmers stated that their village has attained better livelihood through rubber cultivation. Their incomes and spending power have raised and they could afford higher levels of consumption. Although rubber has brought higher income, several farmers have mentioned that nowadays rubber alone is not enough to improve their livelihood. Rubber income is also not sufficient to buy the necessary amount of fertilizers, pesticides and herbicides.

Most farmers, like MenDa from PanBing, have shifted to rubber because it brought more profit and required less labour. Most of them completely converted their fields, which previously were used to cultivated dry rice, maize or other crops into monoculture rubber plantations.

[1] 1 mu = 0,66667 ha
1 ha = 15 mu

Picture 7: A farmer from NaBan showing his plantation to the NRWNNR officials

The majority of farmers considers rubber to be their most important source of income and state that they rely on it to a great extent. The dependence on rubber varies a lot throughout the villages: from almost complete as in the case of ManDian and PanBing to partial as in the case of NaBan. In NaBan many farmers lease out their land for ca. 1000 RMB per mu and thus have stable income. The majority of farmers depended on rubber almost to a very high degree, since they have no additional land to lease out or to cultivate other crops.

Those farmers who completely depend on rubber income feel also very vulnerable: "*If rubber price is good, life is good. If rubber price is bad, life is bad*" said a female farmer from ChaChang. But many of the farmers also seek for random or seasonal additional sources of income like labour work in banana plantation or in the construction sites in village or in the city in order to diversify their income. Some farmers also grow chicken and pigs (offered by the government) but this second source of income also depends on income from rubber, as feed for pigs and chicken needs to be bought. Before growing rubber, the farmers were partially self-subsisting while now all food needs to be acquired from the rubber income.

The decline of the prices on the international rubber market has severely affected farmers' incomes. In 2008, the rubber price increased up to 32 RMB per kg of liquid latex and in 2014 in dropped down to 7 RMB per kg. Thus the household income of many farmers has significantly decreased. Several farmers stated that in 2014 their yearly rubber income was between 18.000 and 30.000 RMB which they consider very low and insufficient to feed

the family. When the rubber price was high, every day they could tap a little, bring the juice to the collecting point and get a few thousand: "*It felt so good*", says XueShang, a young village head from PanBing. "*But if the rubber prices stays around 7-8 RMB per kg*", he continues, "*I would still not cut the rubber and lease out the land. Even this low price ensures a stable decent income. I don't understand why others cut down their rubber and lease the land out for 2500 RBM per mu. They could still earn more with the low rubber price*". XueShang says that the rubber income even at this low price is more or less enough to cover their life expenses. "*For big purchases like TV, it is not enough. But for every day needs it is ok*", he says. This illustrates that farmers have a different understanding of "how much is enough" but also perhaps that many farmers prefer a small but stable income which doesn't imply labour rather than higher income with a high labour input.

Several farmers share XueShang's point or simply state that if the low prices hold on, they would go out to seek for work in the city and wait for market price to rise again in the meantime. They have made a big investment in their rubber plantations, and this represents a value for most them. There was no interview experience with a farmer who started cutting down his trees, but such cases were often mentioned by the interviewed farmers. For example some village inhabitants cutting down the trees in order to lease out their land for banana plantations or in the high altitude for young mango trees.

Thus it can be concluded that the farmers tend to associate rubber cultivation with higher income and are strongly dependent on it. Although they are currently experiencing problems due to the low market price, most of the farmers still value the rubber income, because of the prior investments and because it is earned with less effort than in case of other crops.

Livelihood and Working Life

After the introduction of rubber cultivation, the standard of living in the villages increased a lot. Several farmers stated that rubber has increased their purchasing power. Some farmers stated that before the introduction of rubber they sometimes did not have as much and as good food as nowadays; but now, one farmer stated, "*everyday is spring festival*". An old farmer in the village of ManLu/KeMu told us, that he used to live in a house made out of grass when he was a young man. Also the farmer WenLongLi from ChaChang told us that the overall infrastructure has improved as roads are paved nowadays. During the rubber boom, farmers gained substantial welfare and were enabled to build bigger houses. Especially in the village of ManLu/KeMu and NaBan this was very obvious to the research group. As famers told us this was not only due to the increased income through rubber, but also due to government subsidies, which were given to certain minorities, like the Dai people living in ManLu/KeMu.

Picture 8: Farmers stated, that since they started cultivating rubber, they have been able to afford eating meat every day

In all villages there are at least some farmers who own vehicles such as trucks, cars and motorbikes. In ChaChang the interview group has been told that everyone in the village has a washing machine.

Also in terms of working habits farmers' lives changed a lot. Rubber requires less working input than other cash crops and this work is usually done during the night. The off season lasts four month. This time is used by some to go to the cities or other farms to work as migrant workers. Others stay in the village to enjoy their free time.

Most famers stated that they like their working life in general and especially in comparison to other farm work. Ai Jiao from ManLu/KeMu for example stated "*I prefer rubber, as it is much less work to do and I am getting a higher income out of it.*" This was also (especially) stated by older farmers which remembered the time before rubber cultivation. It was also stated by one female farmer that rubber cultivation is easy to learn and conduct in comparison to other farm work.

Several farmers stated that they like rubber because the work can be done during the night in comparison to the other crops they cultivated before like maize or rice. This became clear throughout the field-research when the students themselves experienced an extremely hot temperature of more than 40° Celsius during noon.

Source of income for the next generation

Passing a certain activity like the cultivation of rubber to the next generation is seen as a form of putting a value on this activity. Passing on the activity as a rubber farmer was only of minor interest. Only in 9 out of 35 interviews the interviewees talked about their future plans for their land and for their children. Nevertheless most of the famers stated that even though they like their way of life and the life in the village, they want their children to 'achieve more' (mostly in academic terms). A young female farmer from ManDian stated: "*I want her to live in the village but also to study well. I think that a farmer's life is too hard for my daughter.*" Only one farmer responded differently. Asked if he wants his son to continue the farm he answered: "*Yes. I would like my son to help me and I want him to continue growing rubber and other plants.*" (It is noteworthy that this famer cultivated much more land than most of the other farmers – around 100mu.)

6 Problems as perceived by the farmers

6.1 Problems arising from rubber cultivation

This section focuses on the problems which farmers perceive concerning their rubber cultivation. A first investigation of problems and potential risks connected to them can be found in Aenis et al. (2014). The main problems as stated by the farmers were:

- Weather events influence on output
- Price instability
- Lack of land
- Lack of financial ressources
- Increasing input prices
- Changes in microclimate (water shortage, higher temperature)

Two years later, and with a focus on the potential effects of perceived problems on willingness to accept land-use change, problems of the farmers are:

- Income losses
- Lack of alternatives
- Scarcity of land
- Planning insecurities
- Access to knowledge of rubber cultivation and innovations
- Enviromental Problems

Table 3 shows a valuation of the problems based on the frequency of this response. As can be seen, some problems have become less important to farmers. While two years ago farmers in KeMu stated that weather events were the main problem in rubber cultivation, the study at hand shows that in 2015, clearly, economic problems have the highest priority.

In addition to the problems identified by AENIS et al. (2014) “planning insecurities” and “access to knowledge” were mentioned.

Table 3: Problems of rubber cultivation as perceived by the farmers

Problem	Value	Reason	Consequences	Likely effect on WTA
Income losses	+++	Decrease in rubber prices, stable input prices	Welfare losses, struggling to feed the family, decreasing standard of living, increasing workload per person, less use of fertilizers	Positive
Lack of Alternatives	+++	Climate, geography (steep land) not suitable for all crops, lack of knowledge limits success of planting alternative crops / intercropping, low education limits alternative job possibilities in the city	Very little income diversification, high vulnerability to shocks in rubber demand	Negative
Scarcity of land	+++	Land that may be used for agricultural purposes limited within NRWNNR, forbidden to further cut down tropical forest, land diminishes when split over several children	Little profit margin cannot be counterbalanced by high quantities, Aversion of testing innovations / crops with little or no successful experiences in the village	Negative
Planning insecurities	+	Fluctuation of rubber price	Fears about the future, Fears concerning children's education possibilities, passiveness	Positive
Knowledge of Rubber Cultivation and Innovation	+	Lack of access on information, limited training and extension service provided to the farmers	Low implementation on good farm management practices, aversion of implementing the innovation options	Negative
Lack of water quantity	+++	Rubber cultivation (rubber sucks the water out from the soil)	Decreased water supply, drier soil	Positive
Lack of water quality	+	Use of agrochemicals, no proper waste collection point, waste beeing thrown into the river	Potential health problems, villagers have to obtain water from further away	Positive
Climate Change	+	Deforestation, global development, global CO2 emissions	Rising temperature, more extreme weather events	Positive
Soil degradation	+	Cultivation of monocultures, use of agrochemicals	Drier and less nutritious soil, less productive soil	Positive

+ : >30 % of interviewees named and discussed this problem

++ : >50 % of interviewees named and discussed this problem

+++ : >70 % of interviewees named and discussed this problem

Income losses

When asked about their problems and difficulties in rubber cultivation, income losses and an insufficient current income were the problems most frequently mentioned. In total, 26 out of 35 interview partners described this as an important challenge in rubber cultivation or even their main worry in life. The main reason for this is the decrease in the rubber price during the last years. Several farmers stated that between 2006 and 2008 the price for rubber had increased rapidly to a maximum of 32-35 RMB[2]/kg. But during the last three years this price had decreased to 20 %. Concerning the lower rubber price before 2006, one farmer stated that even though 20 years ago the price was as low as today, the purchasing power of 1 RMB has severely decreased since then.

Another reason for income losses was the fact that costs of cultivation had increased relative to the gains, as the input prices have remained stable. Several farmers mentioned that due to the high price they could not use fertilizer as often as it would be necessary to reach maximal outputs, which in turn diminished the income further.

While the decrease in rubber price caused welfare losses to all farmers, it affected different farmers' lifestyles in different ways. The family income from rubber cultivation in 2014, as stated by the interviewed rubber farmers, ranged from 10.000 RMB to 150.000 RMB with differences being due to the size of land, number of trees owned, maturity and conditions of the trees.

Farmers with comparably big farms (from 30 mu – 100 mu), who are able to employ workers to help them with their rubber cultivation, stated that they had to raise the share of the profit that they paid their workers from 30% to 40% in times of low prices.

Some farmers, who had increased their level of welfare substantially during the rubber boom, stated that last year's price was not enough to maintain their past livelihood: "*At this time we could afford to go and enjoy ourselves in the city, which is not possible anymore*" (farmer from ChaChang). In ChaChang, one family explained that they had to take their children out of school and send them to another farm to do migrant work.

Others, having little land, stated that even when the price of rubber was high, it was hard for them to make a good living from rubber cultivation and that they had been struggling to feed their families from their income in 2014.

Consequently, there were four farmers stating that they considered giving up on rubber farming if the price stayed this low. Two farmers stated explicitly that they will keep their rubber trees, even if the price stays low and four more farmers explained that they see no alternative to rubber.

[2]1 RMB = 0,12257 EUR or 0,16265 USD (Average exchange rate: 01 Jan 2014 – 31 Dec 2014);
1 EUR = 8,16433 RMB (Average exchange rate: 01 jan 2014 – 31 dec 2014)
. 1 USD = 6,14316 RMB (Average exchange rate: 01 jan 2014 – 31 dec 2014)

Lack of alternatives

The lack of feasible alternatives that could exceed even the relatively low current income from rubber cultivation is hindering many farmers from diversifying their income at a significant scale. Some of the farmers stated that they use all the land they have for rubber cultivation, while most of them have some additional sources of income, for example through planting other crops or working as a commuter in the city. However, rubber cultivation is the main source of income to all of the farmers interviewed and alternative sources of income generally account for a very small part of total income.

Concerning agricultural alternatives, few farmers have started to plant other crops, such as dragon fruit, mango, banana and dendrobe as the rubber price went down. A farmer from ChaChang, who has rented additional land for this purpose, told us that he has been making losses from cultivating banana during the last two years. However, he will have to continue, since he has rented the land for 6 years and cannot quit the contract. Some farmers also stated that it was not possible to cultivate fruit trees on their sloped land. Many farmers explained that they are not growing anything else as they do not have any more free land. The investment made in their rubber plantations hinders most of the farmers from cutting down productive trees to plant something else on this land. Each generation of rubber trees occupies the land for about 30 years and eliminates the possibility of an alternative land use. Nevertheless, one of the farmers from ChaChang told us that he considered renting out half of his land if the price was 2000 RMB/mu, even though he knows that people renting the land will cut his rubber trees. This shows that some people are searching for agricultural alternatives that can generate a sufficient and stable income.

Another possible agricultural alternative could be the return to subsistence agriculture. A famer from ManLu/KeMu explained, that when they were growing rice and maize they also depended completely on the price of these two crops, but at least they could also consume their harvest. Now, that they are cultivating rubber, they need to buy food from the income of the latex, which makes them more vulnerable to price decreases. Another farmer also stated that his second source of income, chicken and pigs, also depends on his income from rubber, because the feeding needs to be paid from rubber profits. In general, it was less than half of the farmers that had some livestock, often for their own consumption. However, none of the famers actually considered returning to subsistence agriculture and several farmers stated that they had improved their present standard of living is still higher than it used to be under subsistence agriculture.

Non-agricultural alternatives included working as a commuter in the city and doing so-called “migrant work”, such as construction, cleaning or car repairing in the city. Leaving the village to do migrant work was seen as a feasible, though less desirable alternative by a number of farmers. However, as many farmers only have primary education, their possibilities are mostly constrained to construction work or cleaning services.

Scarcity of land

Being asked about their main problems, about half of the rubber farmers answered that they do not have enough land, with some of them having as little as 10 mu of land for the whole family. The farmers we interviewed cultivated between 10 mu and about 100 mu per family. People that first settled in the villages were mostly given 10 mu per person. The land is typically handed over to the children. Today, when somebody new comes to the village through marriage, he or she does no longer receive land from the government. In these cases the land per person often diminishes as it is passed on to the next generation. This is a concern, as farmers in the visited villages often had two or more children, because the ethnic minorities on China are allowed to have more children than other Chinese citizens. The limited land was frequently mentioned as a reason why farmers are not planting other crops or trying to cultivate something new. As it is prohibited to cut down natural forest the only possibility to gain more land is by leasing from other farmers within or outside the NRWNNR.

Future planning insecurity

Another problem perceived by the farmers were future planning insecurities due to the ups and downs in the rubber price. Regarding farmers expectations for the future, the majority of farmers stated that they do not know how the price of rubber will develop. One farmer from PanBing stated that he believes that "*the government can handle the price issue*" while a farmer from ZhanZhiZhan said that the development was a question of luck.

This insecurity triggered fears about the possibility to maintain one's own livelihood as well as about future possibilities of one's children. While "*Better education for the children*" was the most important ambition named by villagers interviewed by Aenis et al. (2014), we find that 2 years later income decreases had already forced some farmers to take their children out of school. In this context, for even more families planning insecurities due to price fluctuations have led to anxieties about not being able to finance childrens' education in the future.

Knowledge of rubber cultivation and innovation

Lack of knowledge and information is one amongst the substantial problems encountered by the farmers in the study area. Out of 35 interviewees, 5 farmers described their situation to access information, training and extension services as unclear and pointed out the importance of other stakeholders (government) to provide such services. This results in a lack of knowledge on good farm management practices and innovations related to intercropping and a water protection zone. One farmer from PanBing mentioned the importance of training for seedlings, money management and cultivation techniques for farmers, especially for young generations. One other farmer emphasised that government assistance could improve farmers' chances to implement intercropping successfully.

He personally does not have the information regarding the intercropping species nor does he know the value of it. In addition to a lack of knowledge concerning intercropping, a similar need for assistance was also pronounced concerning the implementation of a water protection zone. A farmer from ChaChang noted: "*It is necessary to protect water, but we do not know how to*". Concerning the access to information, one farmer from ZhanZhiZhan has already tried to use the internet; however, according to her the results are not reliable and applicable to her situation.

Environmental Problems in the Study Area

During the in-field research phase, most interviewees could notice the environmental problems in the NRWNNR. Problems associated with water quantity are the primary concern for most of the farmers. Climate change, soil degradation and waste disposal issues were also stated. As proposed by the farmers, several factors influence the environmental condition in the area. Regarding problems associated with water, climate change and land conversion to rubber plantations are possible factors that influence the water quantity as well as the water quality. Similarly, the rubber cultivation practices such as fertilizer and herbicide usage affected the soil condition in the region which leads to soil degradation. Under these circumstances, the nature of the environmental setting might be disturbed and may further affect the livelihood of the local people in the future.

Water (quantity and quality)

The majority of the farmers paid attention to water quantity problems in the study area. More than 70% of the farmers described the water situation in the village as the main environmental problem they perceived. However, water quantity is a major subject to the discussion regarding water issues. A farmer from PanBing generally was not aware of the environmental problems, but he was concerned about the water quantity reduction especially during the dry season. Some farmers could associate the water quality problem with rubber cultivation. Xue Shang from PanBing stated "*the biggest environmental problem is water quantity. Rubber sucks out a lot of water; therefore we do have a water scarcity problem*".

Meanwhile, although most farmers did not mention water quality, farmers from ZhanZhiZhan were quite aware of the effects of pesticides and herbicide usage in rubber cultivation of their water source. Hence, they avoid using water from the river as their drinking water.

Several attempts have been carried out to improve the situation; however, the ownership issue is very complex. Therefore, most farmers proposed a round table discussion between village heads since the water problem encompasses many villages in the area. A farmer from ChaChang stated: "*The village heads need to do something. We are just normal villagers, there is nothing we can do*".

Climate change

We found 4 statements during the in-field research phase regarding climate change. Concerning this, rising temperature was mostly stated by the interviewees. A farmer from ManLu/KeMu noticed a difference and noted that the temperature was higher than before; he also added that the temperature seemed to be higher for the year 2000. In addition to that, a farmer from ChaChang also mentioned a temperature variation (e.g. during the night it got very cold in the last 2-3 years).

Soil degradation

4 farmers have been experiencing problems due to soil degradation. A young woman from ManDian underlined the situation and mentioned that the soil is becoming drier due to deforestation. A similar statement was also given by a farmer from ManLu/KeMu. He had noticed that the soil was drier than before. He admitted that he used lots of fertiliser that might affect the soil condition.

Waste

The issue of waste management has been raised during the interview and observation phase in the research area. However, the waste disposal issue was not necessarily related to rubber cultivation. Instead, the waste disposal issue could lead to the problem of water quality. The discussion about waste disposal, specifically occurred in ChaChang and ZhanZhiZhan. Two farmers stated the absence of waste management in the village, and monetary issues were the reason behind it. Generally, most villagers threw it into nature or burned the rubbish. Only in few villages there was a partial waste collection. Since there was no collective waste disposal in most villages, these farmers further considered this as a problem that might be related to environmental problems.

6.2 Problems related to the cases

6.2.1 Farmers' statements

While the majority of farmers were interested in hearing about the possibilities of intercropping with endangered species and of implementing a water protection zone, they also mentioned a number of concerns and criticism towards the propositions. These problems, their reasons, consequences and potential solutions as stated by the farmers will be presented in detail on the following pages.

Table 4: Problems related to Water Protection Zones as perceived by the farmers

Problems	Reasons	Consequences	Potential solutions
Property rights	Land around water sources is mainly owned privately	Implementation of a WPZ depends on the land owners' decision, not all would be willing	State-owned land
Chemicals used uphill still contaminate the land downhill	Leakage/run-off	Would make the WPZ useless	Efficient monitoring, State-owned land
Decision-making and monitoring is too complicated	Too many people involved	Hard to find consensus among the farmers, hard to control use of chemicals	State-owned land
Compensation	Farmers would undergo income losses	Farmes must be given other arable land or monetary compensation	State-owned land, Governmental funding

The main problems connected to the implementation of a Water Protection Zone as well as their reasons, consequences and potential solutions are shown in table 4.

14 interviewees commented on the potential implementation of a Water Protection Zone. The answers concerning this case were very similar: The implementation of a Water Protection Zone is not seen as potentially successful. The main reason stated by most farmers is that the land around the water sources is private land. Every farmer can decide for him- or herself about the amount of pesticides and herbicides sprayed, and rubber production without chemicals would lead to much lower or no yields. One farmer said that even if the land in the core zone around the water source would be protected, the chemicals sprayed on the plantations uphill would still contaminate the water, especially through run-off after heavy rains. Other farmers stated that there are simply too many people involved and that it would be a problem to find consensus and to control the water source and the farmers' use of chemicals. Another issue that was often mentioned is the need to compensate the farmers for their income loss which would be the consequence of a ban of chemicals in the water protection zone. Farmers would not be able to generate income from this land anymore due to unhealthy or non-developing rubber trees. Thus, most of the interviewees proposed a compensation for these farmers as a possible solution in the form of giving them land somewhere else or paying them for every mu of land they "lose" to the core zone of the Water Protection Zone. Communal funds that already exist in some villages are not seen to be sufficient for this plan, some farmers think that it would be impossible to compensate the farmers and that there is "*no way that they do not plant rubber trees*" (Village head, ManDian).

Moreover, some farmers think that an intervention from the governmental side would be helpful or maybe the only solution to implement and finance this idea. Most of the farmers who referred to the problem of the privately owned land also said that it would be much easier if the land in the core zone would be owned by the government.

Concerning the awareness of the problem and the need for a Water Protection Zone one farmer said that "*... the villagers know, that they cut the primary forest, and that rubber takes a lot of water, but they don't do anything against it. They know they cause environmental problems* (…)". This and similar statements by other farmers clearly show the high importance of rubber as an income source for the majority of the farmers in all villages.

Table 5: Problems related to intercropping as perceived by the farmers

Problems	Reasons	Consequences	Potential solutions
Prejudices	Bad experiences with intercropping; Observation of other farmers failing	No willingness to try/ try again	Risk reduction Good examples by others
Old plantations	Shadow spent by older rubber trees	Lack of sunlight for intercropping species and, thus, failure	Knowledge and assistance regarding shade-tolerant plant species
Lack of inputs	Necessity of additional (costly) fertilizers and water	Most farmers do not have the money to pump water up the hill or to buy additional inputs	Governmental subsidies, Knowledge and assistance regarding tolerant plant species
Lack of knowledge and assistance	Bad communication	Failure; Low yields	Improve and ensure knowledge and assistance
High risks	Farmers have to invest in various inputs; No price guarantee; No market guarantee	Low yields, low prices and marketing problems can ruin farmers financially	Free seedlings; Price guarantee for harvest; Harvest contracts; Marketing agreements
Lack of time and manpower	Farmers would have to spend more time and manpower for the additional species; Some are too old/sick	Trade-off between rubber cultivation and cultivation of intercropping species	Knowledge and assistance regarding tolerant plant species

Table 5 shows the problems their reasons and consequences as well as potential solutions concerning the intercropping case.

28 farmers could be interviewed about their opinion, their willingness and anticipated risks, concerning intercropping their rubber plantations with the three endangered species that were proposed to them. Naturally, the first answers that farmers gave were concerning their general attitude towards intercropping. The main problem that could be observed was that most farmers have prejudices concerning intercropping due to bad experiences. 16 farmers stated that they already tried intercropping in their rubber plantations. 9 of these farmers did not have a sufficient yield or advantage from intercropping and, thus, were not able to generate income from this activity. 5 farmers were at least partly successful, one was in the initial phase of intercropping and one stated that he was only doing intercropping to follow the NRWNNR directions. Mentioned species were Flemingia, Tea (also Stale fiavour), Ferns,

Taxus, Agila wood and Teak wood as well as Devil's pepper. 11 farmers did not try intercropping with any species yet.

The main reason why 9 of the farmers stated that intercropping has not been successful is the shadow produced by older and taller rubber trees. Other reasons for failure were thought to be a lack of water, nutrients, insecticides and/or herbicides for the intercropping species. Furthermore, some of the farmers were not sure if they had planted the intercropping plants the right way or if they had applied pesticides or herbicides at the right time. This supports the findings discussed under 8.1 showing that most farmers are lacking a clear source of knowledge and assistance.

Most of the farmers that already tried intercropping stated that they are not willing to proceed or plant new species. Farmers who never tried intercropping before were more willing to try intercropping with the three endangered species, especially when they would be given the seeds or seedlings for free or if there would be a price guarantee for the harvest.

The risks perceived by farmers who already tried intercropping were the price for their harvest, the costs of seeds or seedlings and the shadow produced by older rubber trees. Similar to this, farmers who did not try intercropping yet also worried about the price for the harvest, the cost of the seeds/seedlings, the shadow produced by rubber trees but also about low yields, the location of their plantations on hillsides, marketing and a low-quality harvest of rubber or the intercropping species. Moreover, for both types of farmers it became clear that the trade-off between rubber and intercropping species concerning time and manpower is an important issue. One farmer also stated that he is not the one to decide whether to try to intercrop with new species. He stated that the older generation's opinion has to be respected in his culture so that in his case he would have to ask his father before doing major changes concerning their farm management.

Finally it is to say that there exist big doubts on the success of intercropping amongst the farmers and almost no intrinsic motivation to start intercropping in their rubber plantations is given. It becomes clear that either good experiences and examples are needed or that the risk taken by the farmer must be decreased by providing them with free seedlings or information about the probable economic benefit.

6.2.2 Own observations

The Water-Situation in NRWNNR

In many villages the water spring is located within the rubber plantation and due to the use of herbicides (to clear the ground before tapping-season) and of fertilizers (to increase plant growth), water quality at the source can be affected by these agrochemicals.

In ManDian for example, the water source of the village comes from a water spring which is located around three kilometres away at the hillside. The water spring is surrounded by rubber cultivation. Five different families own the cultivated rubber land. It is a groundwater

spring, and after the water has reached the surface it flows down openly for several hundred meters before it gets canalized.

Picture 9: Water Source, ManDian

In the foreground of Picture 9 one can see the water source which is densly covered with wild vegetation. However, in the background one can see that rubber is also closely located to the water spring.

A second water resource from a further place is also providing the village ManDian with water. The water coming from the closer water spring is not sufficient for the village demand in summer times. Therefore, the second water resource is necessary. Those two water canals are then integrated into one water supply system before it reaches the filter system. After the water has run through the filter system it is transported through a water pipe to the village of ManDian. In order to increase the water supply quality/quantity of ManDian it is necessary to establish the water protection zone on the hillside of ManDian. In addition, the watershed must be protected the same way in order to avoid negative effects on the water collection point. This requires negotiations with involved stakeholders and increases the costs for a successful implementation of a water-protection zone.

Picture 10: Water supply system in ManDian

One can see how in ManDian the water supplies from two different sources (left picture) are collected in a common water collection tank (right picture)

In ZhanZhiZhan the water demand is covered by one water source above the village. The problem of water quality is closely linked to a garbage problem. The village has no functioning waste disposal system and the villagers contaminate the water supply with domestic waste. A direct link between the improper waste disposal and water quality is recognized by some villagers. Nevertheless, there is a lack of environmental education and the waste problem is a consequence of this.

Picture 11: Missing garbage system in ZhanZhiZhan

Intercropping

In general, intercropping is not a very common agricultural practice in NRRWNNR. Most farmers grow monoculture crops and those who are doing intercropping are still not receiving additional income from this source. In many cases, farmers have deliberately shortened distances between their rubber trees which makes intercropping harder. Usually the village heads are the first to adopt diverse intercropping techniques, because they have a more intensive connection to the NRRWNNR administration and are approached as early adopters.

Since a few years NRRWNNR promotes several intercropping species used for medicinal and timber production purposes. A table has been created which lists the species and their possible benefits and serves as a basis for farmers to order saplings for trials.

Flemingia macrophylla is the most well-known intercropping species in the region, due to the promotion by the government. The NRWNNRB has supported flemingia adoption by farmers through subsidies, giving out free seedlings and extension services. Farmers report to be growing flemingia on areas from 2 to 20 mu. Those who have hillside tend not to grow it because of hard work of carrying plants and water. In the majority of the cases the preliminary impressions are that only a half of the saplings survive due to shade, insects, or unsuitable soil conditions. Besides planting flemingia seems to make a lot of work, since the farmers need to dig big holes. For example in one case a farmer from PanBing said that in order to plant 3 mu, they needed 3-4 days and 4 people.

The second most spread intercrop is Aquila wood (also called Eagle wood or Aquillaria crassna / yunnanensis). Some of the farmers collected the saplings themselves in the forests and receive additional ones from the government. Three farmers from PanBing and ManLu/ KeMu have shared their experiences on intercropping with tea (camellia sinensis). Unfortunately sulfur used in rubber pest management harms tea plants.

Two farmers from PanBing reported their experience on maize intercropping which they sued to feed pigs and chickens and brew maize wine. Maize could grow rather well until the trees got big. One farmer from Pangbing also tried dry-land rice but didn't continue this practice. Besides some farmers in ManLu/KeMuare experimenting with devil's pepper (Rauvolfia vomitoria) in ManLu/KeMu. One farmer in ManDian tried out Sandal wood and Teak wood which can be used for 50 years (longer than rubber).

The opinions about intercropping are very diverse. Many farmers are curios and interested, many are discouraged because no convincing results are available yet. Nevertheless most agree that if intercropping is to bring potential use, it should be practiced in young plantations with sufficient space between rubber trees.

7 Factors influencing wilingness-to-accept

The most important factors as derived from the field work are economic, social, personal, and institutional ones (Table 6). First they will be analysed separately for each case.

Table 6: Overview of Factors

Cases	Factors	Importance
Water Protection	**Intrinsic Factors**	
	Villagers position in the village	+
	Awareness of water problems	+
	Dependency on the Government	++
	Extrinsic Factors	
	Monetary Compensation	+++
	Property Rights	++
	Collective Action within the village	++
Intercropping	**Intrinsic Factors**	
	Approval from the older generation	+
	Knowledge on Intercropping- monetary value and synergy effects	++
	Extrinsic Factors	
	Cost subsidy	+++
	Market access	++
	Harvest price	+++
	Good practice example	+++
	Information& network	++
	Location & Infrastructure of the plantation	+
	Support by government	++

In each category there is a range of factors. As one can see from Table 6, it is detectable that many factors influence acceptance of land use change in the study area. The factors are distinguished by intrinsic and extrinsic factors based on their origin, and the importance/ valuation is given for each factor according to the answers given by the interviewees.

In the table three plus signs indicate an extreme importance of the factor and as the plus signs reduce, the importance-level decreases. The valuation is based on two criteria: Firstly, the frequency of a factor mentioned by the villagers in the interviews. Secondly, a subjective evaluation of how the interviewee described the factor, which includes the intensity and non-verbal expression which are hard to be quantified. Explanations on the influences of each factor will be presented in the next section based on the two cases: water protection and intercropping. Then, similarities and differences between the two cases will be discussed.

7.1 Water Protection Zones

Monetary Compensation

Economic factors like monetary compensation are within the group of extrinsic factors. It is clear that the monetary compensation itself is an extrinsic one, due to the fact that it is given by external agents, not from farmer's own endowments. It has a positive influence on farmers' willingness to accept land-use change. This factor was most mentioned by the farmers and the most discussed topic when the water protection zone was introduced to them during the interviews. Compensation is useful when farmers experience an economic loss trough the participation in the water protection zone. Most farmers interviewed stated that they value the profit resulting from the rubber plantations higher than the environmental benefits from a water protection zone. In this case, the compensation might make farmers value water protection relatively higher than before.

One farmer from the ManDian village immediately suggested monetary compensation when an interviewer introduced the new idea to protect water. Besides him, although most interviewees agreed upon the idea to protect water, they argued that the idea should be followed with compensation in order to cover their loss derived by it. In addition, opinions on the kind of compensation were shown respectively according to individuals and villages. Regarding the source of monetary compensation, one pointed on the communal fund of his village. He said that he would be willing to compensate the loss by the money from the fund, but added that the fund will not be sufficient to cover all monetary compensation for villagers who might be affected by the new idea. On the other hand, in PanBing village, the village head stated that his village is already negotiating with the government about the amount of compensation for some rubber trees near the river which have to be cut down in order to protect their water source. He said that the government should be a major compensation agent. At present the villagers demand 320 RMB per rubber tree, but the government does not agree on this amount. Another farmer from the ManDian village suggested that the compensation could be combined as monetary and land compensation and that the monetary compensation should last until he generates income from the new piece of land.

Social Factors

In the case of water protection, collective action in the villages and individual positions within the village can be taken into account as potential social factors influencing the willingness to accept land-use change. Since villages in the study area are still maintaining a form of ethnic community system, it can be expected that social relationships play an important role in the consensus building on certain issues.

Collective Action within the village

Collective action to make decisions in the villages seems to be common and also apply for the protection of water. Experiences with collective action in the villages cannot directly explain the individuals' willingness to accept land-use change for water protection. However, it was seen that past collective decisions in the villages can positively affect villagers' acceptance of certain initiatives and regulations as an extrinsic force. It should be noted, that people in the villages often have to follow the collective decision regardless of their will. In addition, compliance with the collective decisions of the village seems to be a formal prerequisite to get involved in the decision-making. Therefore, it is likely that external pressure to accept decisions is linked to collective action.

Collective action was frequently mentioned by the farmers and it seemed that they naturally accept decisions. Most water supply systems are self-managed by voluntary engagement of villagers with some regulations of the government. One farmer from the ChaChang village mentioned that his village holds a meeting once or twice a year, and designates people to be in charge of the maintenance of the water infrastructure. Further, in PanBing village a fence around the spring and pipes was collectively built. Also, another farmer from PanBing mentioned that each household in the village paid 100 RMB to construct water pipes in order to link the water source with each household for better water quality. Although these collective efforts were mainly driven by the initiatives and regulations of the government, it is remarkable that the village people were willing to accept the collective decisions of the village.

Villagers position in the village

In addition, the position of an individual in the village is another social factor influencing the willingness to accept land use change. This is due to the fact that special roles determine the level of engagement in decision making process within the villages. If a villager is involved in decision making, his/her willingness to overcome current problems facing the village is relatively high. Accordingly, a villager without a special role in the administration of the village will have relatively less motivation to solve problems and likely expects others to do it. Consequently, the position in the village either inhibits or encourages motivation to be involved in land-use change.

Even though only few farmers mentioned the factor and was not discussed specifically during most interviews, it seemed that the farmers always kept in mind about what are their roles in the village. Two farmers from ChaChang showed passive attitude towards improvement of the present situation of water protection. They said that since they are normal villagers there is nothing that they can do for the improvement. Instead, they strongly believed that the village heads need to do something for water protection.

Institutional Factor

In the case of institutional factor, property right is the main issue. Both individual property right and property right between villages should be considered respectively. In addition, when we analyze the institutional factors, it seems that we cannot easily say that the factor directly affect the willingness to accept the land-use change. Instead, it is mainly considered as an external constraint that hinders theimplication of land-use change for water protection.

Property Rights

Regarding the institutional factor it is certain that property rights play a role as a constraint to implement an alternative to protect water. The government cannot simply implement the water protection zone due to the individual property right. Also, since one village's decision to protect water around the watershed is not valid on other villages, it is ineffective to make the village's own decision respectively. Herein, the constraint of property right makes the solution unrealistic. Then, the suggested solution cannot arouse farmers to have the willingness to accept the land use change. Therefore, it seems that the external environments for implementation, the existence of property right and their visible limitations regarding the implementation, influence the farmers' decision.

This factor was often pointed out by many farmers who further showed interests in the water protection zone. They tried to give their feedback on it, and they usually mentioned the property issue as an essential point. It seems that the property right is importantly considered as a factor for the implementation. When the water protection zone was introduced to the villagers, they were suspicious of the possibility of its implementation in effect. One village head from the PanBing village pointed out that it will not work because there are different households along the river and each household has their own property right on the land. He added that the village head cannot control their activities or prohibit them from growing rubber trees. Two farmers from the ChaChang village also mentioned that only a small part of the land around the water source is owned by the government, and argued that most of it is private and the people who own the land should decide whether to accept the water protection zone or not. A farmer from the ZhanZhiZhan village said, if there are one or two families involved in the land with respect to the water protection zone, the implementation might be possible.

However, he added that since more than five families are generally involved in the land it seems that it is impossible and complex to implement the idea.

One intervewee from the ChaChang village said that the land around the water source is separately owned by households from different villages. One from the NaBan village also mentioned that some small trees around the watershed are belonging to other village, Beng Long, and it is hard to control their behavior concerning the water issue. Then, he suggested that this complicated issue requires the intervention of the government, because a further discussion with the respective villages seems impossible to happen without proper arbitration of the government.

Personal Factors

In the study, personal factors are internal endowments that would affect the willingness to accept land-use change for water protection. Awareness of water quality and quantity with understanding of water protection in relation to rubber cultivation, and dependency on the government are identified as personal factors.

Awareness of Water Problems

In the case of the awareness of water quality and quantity, it is clear that villagers are generally aware of the problems related to the water issue. However, the villagers show different levels of understanding of water protection with respect to rubber cultivation. Basically, water quantity reduction is widely recognized by people in most villages, but water quality issue is differently perceived according to the villages. In fact, this factor cannot be directly linked to accepting the land-use change. Instead, it is more likely internal individual properties that affect the problem perception. Without awareness of water problems and understanding of that in relation to rubber cultivation, the villagers cannot see the necessity of the water protection zone as a solution to protect their water.

The factor is basically derived from their answers that identify the level of farmers' awareness on the water issue. Although the awareness might play an important role in the perception of the problem, it is certain that its importance seems less than the economic factor because the farmers normally mentioned the necessity of water protection after they pointed out the monetary compensation issue, and many farmers did not mention the water protection before the interviewers refered it. Farmers from the PanBing village said that the biggest environmental problem they see is water quantity, and they believe that this is because of rubber cultivation that soaks up a plenty of water. Unlike the water quantity issue, one mentioned that water quality is not a big deal after they remove the rubber trees around the water source and construct the purification system with four water tanks. This fact was confirmed as well by other interviewees from the PanBing village. However, some of them did not perceive the water quantity and quality problems in relation to rubber cultivation.

Interviewees from the NaBan and Manlei villages similarly perceived the water issue, like the people from the PanBing village. On the other hand, the people from the ManDian and ChaChang village mentioned that the water quality is a problem for them. Moreover, one young man said that he thought the water is still drinkable even the water is polluted by herbicides. This explicitly shows the lack of understanding of water pollution and protection.

Dependency on the Government

Dependency on the government is another personal factor which is crucial for accepting land-use change for water protection. Individual farmers might have different levels of dependency on the government according to their characteristics and endowments, and it is differently constructued through social, economic and institutional situations. In the study area, it seems that most farmers feel highly dependent on the government, and most of them believe that the government would find solutions for water problems. A possible explanation is the strong influence of the NRWNNR for a long time since it was designated as the natural reserved area. Hence, they are not used to look for solutions concerning their agricultural business. This means that in spite of their problem perception, solutions may not be implemented without governmental intervention.

Although dependency on the government was not seriously targeted to be identified during the interviews, farmers usually emphasized the role of government very often. This shows farmers dependence on the government and confirms that dependency itself could be one of the factors that affect the land-use change. While the government is an external agent, dependence on the government is an intrinsic factor, as it decribes a state of mind within the individual. It is likely that this factor is more important than other intrinsic factors on the basis of its intensity from the farmers' answers. A farmer from the NaBan village said that the water protection zone would be meaningless if it is not implemented by the government, because nobody would seriously consider the idea if it is introduced by outsiders, other than the government. Another pointed out that if the water quantity decreases in the future, he might ask the government to give him water from Jinghong.

7.2 Intercropping

Economic Factors

Cost subsidy is an extrinsic factor that influences the acceptance of the farmers insofar as it reduces the risk for the farmers. If the farmers are provided with subsidy, the willingness to accept intercropping will be higher. More precisely, the farmers request free seedlings in the initial phase. In most cases, the NRWNNR administrative office is the initial organiser for different intercropping projects. In each village, the officer will leave a table to enable the farmers to order free seedlings. Those farmers with interest will indicate how many seedlings they want to order. Under this situation, it is not surprising to find out that farmers' first reaction is the question whether the seedlings will be provided for free. For example, a farmer from PanBing said that he especially likes the Taxus yunnanensis, and added that if someone would provide him with the seedlings he would try to grow them. Additionally, even though the seedlings are free, the provider itself has an influence on farmer's willingness to accept. A remarkable number of responses starting with the phrase "*If the NRWNNR office…*". Especially for those species that farmers have no experience before, providing of free siblings is a key issue. Once the subsidy is not provided, farmer will not even attempt to plant them.

Market access is an extrinsic factor and means whether there is market for selling the product or to an middleman that organises the collection of the harvest. When the market channel for their specific products is clear, willingness of acceptance is increasing. Marketing channel seems to be an important factor in order to start intercropping. Farmers have less incentives to get market access by themselves. An ideal model of intercropping would include providing of free seedlings, a reliable middle man who comes to collect and pay the harvest. A farmer from NaBan stated that it is possible for him to plant the proposed three intercropping crops under the precondition that someone will buy and collect the intercropping products. It is obvious that respondents do not want to deal with the marketing issue and an ensured contract farming system. One farmer from NaBan said: "*If it is a good crop, bring it to me – I will grow it and you come and pick it up*".

The **harvest price** is the price farmers obtain for their cultivated products. As an external factor, it highly affects the acceptance level of the farmers. They will be strongly motivated to cultivate the crop if the harvest price is acceptable. Even though it is difficult for farmers to give an exact number to their obtained harvest, the ability of forecasting the harvest price is very important for the decision to cultivate a crop or alternatives. Two farmers from ManDian both pointed out that they would consider planting alternative species if a promising price was given in advance. However, they might know the price in the current market, but not in the future which make them hesitate. In addition, one farmer from ZhanZhiZhan said she cannot really consider the price, because it would take some years until the first income could be generated. This will inevitably involve the length of waiting period for the first income. As most farmers told us, they are not willing to cut down their rubber trees even if the latex price is low. In addition, an endangered species requiring a long

time for growth as well as the lack of the knowledge of current market price for comparison can not convince the farmers.

Social Factors

Approval from the older generation of a change in crop cultivation is an intrinsic factor, affecting younger rubber farmers' acceptance of intercropping as a land-use change measure. When a new intercrop plant is introduced, the farmers will first discuss it with their family. If the family thinks that the crop contradicts the norm of farming practice set up by former generations, negative acceptance is a possible outcome. Among our interviewees, some of them are in their middle twenties, they are the second generation of rubber farmers in the NRWNNR area. Though their parents have already passed the plantation management to them, if change related to the farming practice, like introducing intercrop plants, they claimed that the older generation's opinion and their experience on rubber cultivation still need to be respected. Whether this factor applies to individual farmers depends on the family structure underlying the farm.

Collective action is an extrinsic factor affecting the rate of acceptance of intercropping. When it comes to the time to decide whether to plant a species or not, most farmers hesitate if they are the only one in the village. At the same time, they do also not want to be left behind by other farmers. This can be seen by the fact that farmers responded that they would not like to be the first one in the community to cultivate a new crop, but would do so if there is experience among other villagers. Within the community, one will not find it hard to know what the neighbour is planting in their plantations. As one middle aged farmer in ManDian said, he needs to see there are more than three families planting before he tries the new crop or several families planting together. That means if a crop has been grown successfully by some people in the village, it will be more likely accepted by others.

Knowledge about positive experiences with new cropping techniques is an extrinsic factor affecting the level of acceptance. If people around the decision maker have already had some positive experience with the plant, his or her acceptance will be higher. Based on what is discussed above, only seeing others to plant the new species is not enough. One further condition is that they wait until the others ultimately gain the income from the first harvest. If others fail, they would not take the risk and try it themselves. One case in NaBan shows that as other farmers failed with the attempt of intercropping, this farmer did not want to give it a try. Some of them also gain confidence by witnessing the success in the state farm: "*When I saw successes of the state farm and of other farmers, I visited them, asked questions, learned from them and then tried myself* "(Farmer, PanBing). Some of the farmers are willing to plant small amounts of species that have not been tried before. In general, there are not many positive examples of intercropping according to the farmers in the study area. This might be the reason why many farmers are quite suspicious of intercropping.

7.3 Discussion

Comparing the two cases, two common factors influencing willingness to accept land-use change can be seen: financial support and governmental support. In each of the two cases those are the most important factors, playing a key role for the villagers to accept.

In the case of the water protection zone, financial support refers to monetary compensation given to land-owners near the water sources. Farmers holding property rights near water sources would only accept to conform to the installation of a water protection zone, if their subsequent economic loss is compensated. In the case of intercropping, financial support relates to subsidies provided to cover the cost of cultivation. In order to achieve a high willingness to accept, all villagers participating in the intercropping solution would need this support.

Regarding governmental support, there are also differences between the two cases. For the water protection zone, individual farmers often feel that they lack possibilities of contributing to make a change. This can be due to the fact that they do not hold property rights near the water source or they consider themselves as normal villagers without participatory power in decision-making. As a result, they are dependent on the government or on the village administration for the issue of water protection. For intercropping, farmers lack knowledge on crops and their cultivation. As a result, alternative cultivation to rubber will be accepted if the necessary input and knowledge are provided.

While the implementation of a water protection zone is only possible through collective action, intercropping only requires individual action-taking and therefore a wide range of farmers have already accepted this measure.

In both cases, it can be seen that the economic consequences of a suggested land-use change strongly affects the level of acceptance. Due to the fact that rubber prices are currently low threatening livelihoods, farmers are open to accept measures that bring an economic profit and closed for measures that inhibit income generation. The main difference between the two cases is that intercropping presents an income alternative for all farmers, while the water protection zone would negatively affect the income of farmers near the source, while its beneficiary for all villagers.

Another difference between the two cases is the required level of environmental awareness which is needed for their implementation. In the case of intercropping most farmers are willing to try, if monetary support and technical know-how are provided. However, in the case of the water protection zone an understanding of the impact of their farming practices on water quality and quantity is of utter importance to accept this type of land-use change. Therefore, intercropping relies more on extrinsic acceptance factors, whereas accepting water protection should be more of intrinsic nature.

8 Motivation towards Change

This chapter will deal with the sources of motivation towards change which can be separated into intrinsic and extrinsic sources. Basically, sources of motivation towards change can be analysed through villagers' general attitude towards change, experiences on change and endowments. These factors are derived from their answers, attitude and reaction during the interviews. Table 7 shows the intrinsic and extrinsic sources and the valuation of their importance.

Table 7: Factors of willingness to change

Factors	Importance / Valuation
Intrinsic Motivation	
Livelihood	+++
Age	++
Knowledge	+
Extrinsic Factors	
Surrounding People's Influence: Good Examples	+++
Government Initiatives	+++
External Uncertainty: Rubber Price	++
Training and Education	+
Job Alternatives	+

Intrinsic Factors

To improve their **livelihood** is a major source of motivation towards change among the farmers. Even if a farmer is satisfied with his or her current livelihood, pursuing a higher income level might be a motivation driver towards change. Particularly, in the study area, when the price of rubber was sufficient, they did not need to worry about alternatives to rubber cultivation. However, since the price of rubber has been low for a long time and led to a lower total income from rubber cultivation, they started thinking about alternatives. Many interviewees stated that they might cut down the rubber trees if the rubber price stays low. Aihang and one young woman from the ManDian village mentioned that they are growing dragon fruits instead of rubber. It seems that livelihood is a significant intrinsic source of motivation towards change in the study area.

Age is one of the intrinsic sources of motivation towards change. This is based on the general perceptions that the old are more conservative, risk-averse and less willing to change. Age might characterise villagers' individual endowments, and change is intrinsincly differently motivated. In fact, on the one hand, many young villagers showed an active tendency to try something new, and they perceived change in their life in a positive way. On the other hand, when the old villagers talked about the possible change, they were generally pessimistic. This negative attitude originated from their bad experiences.

Also, a person's **knowledge** intrinsincly influences the motivation towards change. People with knowledge exceeding cultivating rubber, are more open-minded for new alternatives, and this makes change possible. For example one farmer said that her husband knows how to process coffee. Since he has this further knowledge, he could start growing coffee as an alternative to rubber easily. This implies that if the potential of human capital is high enough for villagers to be engaged in new business opportunities, motivation to change could be higher. However, since this source was not often mentioned and the survey was not able to investigate the different levels of knowledge on any subjects, the importance seems lower than other intrinsic sources.

Extrinsic Factors

The villagers are rarely motivated for change by themselves. Mostly, motivation derives from the influence of **others' experience**. One villager mentioned that if others have success with alternatives, he might follow the change. A farmer from the NaBan village pointed out that he tried rubber cultivation because others started before. That clearly shows that motivation comes from others' experience influence, instead of own intrinsic sources. In many villages, cultural and ethnical simmilarities are very important influencing dailiy decision processes. Many villages are relatively small and cohesion between villagers play a key role in their daily life. Therefore, good practise examples by pioneers among the inhabitans might lead to fast adoption process.

Governmental Initiatives: This source can be analysed in line with the previous one. Since villagers are rarely motivated voluntarily, specific inputs are necessary to motivate them to apply changes. For villagers in the study area, government initiatives seems to be the most important driver. Most farmers stated that they would try new initiatives if it is introduced by the government. A variety of regulations and intitives by the government has been implemented in the area since a long time and are regared by farmers as necessary. Therefore, the existence of good government initiatives can be a strong source of motivation towards change.

Rubber price affects the level of total income for the villagers. High price guarantees the profitability of their rubber plantation, and low price situation leads to uncertainty among farmers. During the interviews, some farmers stressed that they expected an increase of rubber price, though they can stay in the rubber sector. However, others mentioned that if the rubber price stays low, they are willing to try alternatives. It clearly indicates, how the external uncertainty of price development affect farmers perceiption differently. It implies that the uncertain situation of future rubber price development could influence motivation towards change differently. The willingness to change might correspond with the endowments of villagers.

Training and education is one source of motivation towards change, because the skills and knowledge generated from training and education could stimulate the entrepreneurship and empower the human capital. It is expected that people who received training programmes are

more willing to try new practices in their life. This is in accordance to the statement of two women in the NaBan village. They were encouraged to start up small business and furthermore they believed that it was a valuable opportunity for them to change their life style. However, since the opportunities of training and education is limited and only a few people can participate in those programmes, this decreases the importance of this factor.

Job Alternatives: Apart from agricultural sector, only Jinghong as the closest big cities provides job alternatives. It means that villagers can migrate to Jinghong to find different income alternatives if the rubber price situation risks their livelihood. Some interviewees from the PanBing and ChaChang village pointed out that they might go to work in Jinghong, e.g. repairing vehicles, working at construction sites instead of tapping rubber trees. The job alternatives can be interpreted in two ways: Firstly, the existence of job alternatives itself creates opportunities for the villagers to change something in their life. If the villagers are more exposed to job alternatives, they could easily consider these as options to improve their livelihood. It implies that alternatives can be a source of motivation towards change. On the other hand, if the villagers can compensate the loss from their rubber cultivation benefiting from other income alternatives, they might not face the main problem of low agricultural income. In this case, the alternatives cannot be regared as a source of motivation. However, since working in the city is not widely practised in the study area, just a few villagers mentioned that factor and weighted it low.

9 Conclusions: ideas to increase acceptance and motivation for land-use change

The field study has investigated factors influencing acceptance of land use change and factors influencing motivation to actively change land use. The interviews showed that it often is difficult to distinguish between extrinsic and intrinsic factors. Maybe they could be both, extrinsic and intrinsic at the same time in the process of considering willingness to accept land-use change.

How can willingness to accept land use change be increased?

It seems that focusing on extrinsic factors is most crucial concerning short-term changes. Since the farmers in the study area were very passive and highly dependent on decisions and recommendations of others, intrinsic factors possibly play a less critical role in their decision regarding acceptance of land-use change. The most important factors found were increasing awareness of economic un-sustainability (1), provision of alternatives (2) as well as compensation for expected income loss (3).

(1) The perceived danger of falling rubber prices, as described in AENIS et al. (2014) has become a painful reality to rubber farmers during the past two years. Nevertheless, farmers still hope that the price of rubber would increase again. Raising awareness that forecasts predict constantly low prices for the next years is likely to have positive effects on willingness to accept land-use change. Changes in the economic situation increase openness for change and might eventually enforce acceptance of change if rubber cultivation in Xishuangbanna should become unprofitable.

(2) During the interviews most farmers seemed quite open to alternative crops provided by the NRWNNR. For example several farmers have tried Flemingia as an intercrop because the government officials working for the NRWNNR provided them with the plants. Most of them also have been very interested in the endangered species the student researchers introduced during the interviews. Therefore there is a potential that farmers would change their current cultivation system if suitable alternatives were provided to them. Nevertheless those new plants would have to fulfil some requirements: They need to be as profitable as rubber and in the best case not require more labor input.

    Alternatives could also entail more income diversification opportunities. Increased offers of capacity development trainings on income diversification could enable farmers to become more resilient in regard to price fluctuations of the rubber market and less dependent on the rubber cultivation income, thus becoming more open to give up a part of their rubber for more sustainable alternatives.

(3) Compensation could also be a means to increase farmers' willingness to accept land-use change, especially in cases where farmers would have to give up some land, for example to implement a water protection zone. This is probably only feasible if the affected famers would get monetary compensation for the lost land. Also other monetary incentives, such as subsidies for trying certain intercrops, might be an opportunity to increase farmers' willingness to either try out new crops or leave some land un-used.

How can willingness to change be increased?

During the interviews it became clear that it is much more difficult to receive information concerning motivational drivers of change. At present, own/intrinsic motivation by farmers to implement land-use changes is mostly very low, and there is a general expectation that alternatives will be presented or compensation provided by external agents like the NRWNNR staff, researchers etc. In the short term it seems difficult to change passiveness, as it is the result of decades of experience of change being induced from above and solutions to problems being provided by outsiders. Nevertheless, the most important factors that could create motivation to change land-use in the future could be deduced from the interviews. These include more education about sustainable land-use (1), empowerment of those farmers that already work actively towards change (2), and, new institutional instruments to include the farmers in decision making processes about the future of the NRWNNR (3).

(1) Education plays an important role to ignite the individual desire to change. More education regarding sustainable land-use and a better knowledge about the science behind agricultural land-use are indispensable regarding motivation to land-use change. Knowledge about the effects of monocultures and agrochemicals on soil and water could lead to a broader environmental awareness in general. Better access to existing information concerning rubber cultivation and knowledge of alternatives are vital for the development of internal motivation.

(2) There have been a few very impressive examples of farmers who did their best to either find alternative crops for cultivation or other side-jobs during their free-time to improve their living conditions. The NRWNNR could put emphasise on the training and empowerment of those people who are already working towards change and keep them motivated as they could serve as best-practise examples for others. An increased number of capacity developing trainings on income diversification could enable farmers to become more resilient in regard to price fluctuations of the rubber market and less dependent on the rubber cultivation income, thus becoming more willing to give up a part of the rubber for water protection or intercropping.

(3) Another opportunity to increase farmers' motivation to take responsibility for their land could lie in a stronger identification of the farmers with a positive vision for their region as well as in a broader inclusion of the inhabitants of the NRWNNR into the political decision making process and in letting them know what is going to happen with the biosphere reserve in the next years. With appropriate institutional instruments where

farmers can express their will and where their opinions will be taken into account when it comes to decision making, farmers' feeling of playing an important role and hence their motivation could be increased.

Table 6 summarises what could be done by whom in order to increase willingness to accept land-use change.

Table 6: What could be done by whom in order to increase willingness to accept land-use change?

Who	**What**
Farmers	• Strive for information • Strive for participation • Try out alternatives • Stay open-minded
Scientists	• Further research on alternative crops and alternative cultivation techniques like intercropping is needed • Test alternatives on test-sides to provide first experiences • The extension work from universities to the farmers need to be improved
NRWNNR	PROMOTE KNOWLEDGE • Providing education / workshops on sustainable land-use • Employ a contact person and inform farmers that they can contact that person concerning questions on sustainable rubber cultivation or land-use change options • Support farmer trials of alternative land use options through continued extension to prevent crop failure and disappointment • Distribute information about economic benefits of alternative land-use • Distribute information about economic forecast, scientific findings on alternative land-use PROMOTE PARTICIPATION • Providing institutional instruments for farmer's participation in the NRWNNR • Training and empowerment of farmers trying out alternatives to rubber cultivation • Facilitating a goal-oriented exchange between farmers in participatory seminars, where farmers develop a positive identification with their region, create an attractive vision and plan concrete steps on what can they do themselves. • Help to help yourself as a farmer, e.g. use of the internet COMPENSATION: • Buy land around water sources • Compensation payments for forgone profits of rubber trees during growth period of new plantation (alternative crops) • Provision of free seedlings (intercrops, or alternative more sustainable crops INTERACTION WITH SCIENTISTS • Provide experimentation sites to scientists, where they can test alternatives
Other Government Institutions	• Provide training and regular extension to farmers on market research and diversification • Providing free education, including environmental education to children

We conclude that in the short and medium term assessing potential success of alternative land use and income generation activities is a mayor challenge to policy and regional/local authorities. In the long run, investment in solid basic education and vocational training is recommended with a careful design of respective programs.

Summary

This report analyses factors influencing farmers' willingness to accept (sustainable) land-use change in rubber cultivation in Xishuangbanna. It is based on a qualitative research approach in the form of a multiple case study combining different methods on site to gain a comprehensive picture of farmers' attitude towards land-use change.

Rubber is the main source of economic income for villagers in this region and has significantly contributed to the improvement of smallholder farmers' livelihoods. However, farmers face challenges concerning rubber cultivation: a heavy price drop in recent years, land scarcity and a lack of income alternativesare perceived to be the major problems. Due to the economic instability threatening the current level of livelihood, farmers are open-minded towards change.

In the case of the water protection zone, the affected land was often not owned by the community, but was property of either villagers or externals. Therefore the possibility of collective action is quite small. Compensation schemes are perceived as an appropriate solution to establish a water protection zone. Concerning the case of intercropping, farmers request cost subsidy for the seeds and some sort of guarantee to gain a reasonable harvest price. In addition to these economic factors, good practise examples as a social factor are highly valued. Nevertheless intrinsic factors are important as well. This means that the individual perception of the problem or the personal position in the family have an influence on land-use decisions.

Another central finding reveals that most farmers see governmental support as mandatory. A major stakeholder herein is the NRWNNR administration. Successful communication between smallholder farmers, local administrations and academic research constitute the base for sustainable land use alternatives for rubber production. In the end it has become evident that there are a great number of factors which affect the process of sustainable land-use change in Xishuangbanna so that the willingness and involvement of all stakeholders seems to be crucial for reaching that goal.

It seems as if stakeholders are much open towards innovative solutions. Most of them are aware of ecological problems such as erosion and, most important, water quantity and quality even if they do not necessarily link them with rubber cultivation. More important is the fact that prices for latex have decreased to less than a quarter in recent years and farmers may have lost two-third of their income. Many farmers stop tapping because it does not cover the costs, particularly if they have to hire labor. They either search for work in town as it seems to be easy to get jobs, mainly in construction work. Or they rent their community land to investors, and later on take day-to-day jobs on the plantations which are established rapidly. Viewed from this perspective the current situation holds an opportunity for sustainable rubber cultivation but also a threat. If farmers rent out land to external investors there is a threat that rubber might be replaced by ecologically more adverse cultures such as banana. The opportunity is that farmers are more inclined to search for alternatives and try whatever solution is offered, as long as they do not risk their income. We observed that farmers seldom try out innovations by themselves. Important reasons are low levels of basic agricultural

education, an extension and vocational training system which is very much oriented towards technology transfer, and insufficient linkages between research and practice. We conclude that in short and medium term assessing potential success of alternative land use and income generation activities is a mayor challenge to policy and regional/local authorities. In the long run, investment in solid basic education and vocational training is recommended with a careful design of respective programs.

摘要

该一调研报告主要分析了在西双版纳橡胶种植中影响农民愿意接受改变(可持续)土地利用方式的相关要素。该一调研学习应用定性的研究方法，在结合实地中的走访观察和分析多个案例的不同情况后，得出一个农民对土地利用改变的态度的全面认识。

对于该一地区的村民来说，橡胶是他们重要的经济收入来源，同时它对小农户生活条件的改善作出了重要的贡献。然而，在橡胶种植中农民们也在应对着各种各样的挑战：近年来严重下滑的胶价，土地的不足和被认为是最大问题的替代收入来源的缺乏。当经济的不稳定会危及到现有的生活下，农民们对土地利用的改变是持有开放的态度的。

为了检验农民的接受程度，在访谈过程中研究员向他们介绍了两个特定的土地利用方案。其中一个有关水源保护区的设立；第二个是林下套种一些濒危的植物品种。在访谈后，我们得出影响农民意愿的相关要素并将外在和内在两种不同要素区别开来。另外，调研的发现和相关的行为和影响改变的推动要素等理论是一致的。就这两个案例而言，经济要素的影响更为显著。

在水源保护区的案例中，那些受影响的土地多不是村子集体所有而是村民个人或外来人员的私人财产。因而，统一集体行动的可能性相当较小。在该情况下要建立水源保护区，对受影响的村民作出补偿被视为可行的解决方案。至于林下套种的方案，农民们要求得到免费的树苗作为成本补贴和保证得到一个合理的收成价格。除该经济因素的考量外，农民们也十分重视先前是否已有成功的实践。当然，内在的因素也相当重要。这意味着每个人对该问题的看法或在家庭中所处的地位也会对如何使用土地有着显著的影响。

另一重要发现反映出，大部分农民认为政府的支持和帮助是必不可少的。而其中一个重要的利益相关者是纳版河国家级自然保护区管理局。在个体农户，当地政府和学者之间有着充分的沟通后，它将转化为构建可持续橡胶种植土地利用的坚实基础。在调研的最后，我们意识到影响西双版纳实现可持续土地利用转变的要素相当的多，因而如何涵括和平衡各方的意愿对实现该目标似乎显得相当重要了。

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Annex

Research topics, research questions, variables, (possible) indicators, Sources

Problem Background

Question	Aspect / Variable	Problem / Indicator(s)
How important is rubber cultivation? Worldwide – China – Xishuangbanna	• Cultivation area • Products • Supply & demand • …	• Absolut area • Percentage of arable land
What are the main relevant problems	• In general – in Xishuangbanna:	• Economy(poverty vs. Ecology • (Farmers)
	• In SURUMER:	• Framework conditions for Implementation of strategies and measures towards the "Development of sustainable rubber cultivation" are unclear
What knowledge is missing?	• Theories • Acceptance in general • Concrete situation	• Theoretical understanding • Acceptance factors of change in general • …from farmers perspective • …

Research topic 1: Conceptual framework

No	Question	Aspect / Variable
1.1	Which "acceptance models" do exist	Name Author Research field
1.2	What are the definitions of the most important Terms?	Change Acceptance WTA
1.3	What are important "individual" Factors?	Economic Social … Examples

No	Question	Aspect / Variable
1.4	What are important framework conditions for acceptance?	Region Political Economic Hierarchies …
1.5	How are factors interlinked?	
1.6	Which aspects are most important?	In General In the specific situation (rubber cultivation, South China)

Research Topic 2: Case studies

For the cases, it is intended to analyse at least

- One case where a relatively high level of willingness to accept changes could be expected: water protection zones;
- One case with a low level of acceptance: intercropping

No	Question	Aspect / Variable
2.1	What elements / aspects characterize the Technique?	General “Green rubber”– Case 1 – Case 2 Different Measures Packages of measures
2.2	What are the changes induced? What impact do they have)	Ecologic benefits - losses Economic benefits – losses (region) Economic benefit for Farmers Scientist perspective – Farmer perspective
2.3	Under which condition is the technique applicable?	Ecologica
2.4	What ressources must the farmer invest	Monetary Labour Changed life

No	Question	Aspect / Variable
2.5	What are (possible) strengths	"Scientific" knowledge Farmers assumptions
2.6	What are possible weaknesses	"Scientific" knowledge Farmers assumptions

Research topic 3: The "value" of rubber cultivation for farmers

No.	Question	Aspect / Variable
3.1	What is the history and reasons of land use change in the past?	policy drivers; economic drivers; personal drivers;
3.2	How is rubber cultivated?	Tapping, processing, cultivation techniques (terracing, monoculture, plantation) NNNR – single farm
3.3	How is rubber processed & marketed	Stakeholders; Storage (Smell, Acidic Chemicals for solidifying, storage place); Prices; Customers (Abnehmer)
3.4	What are the changes introduced by rubber	In Xishuangbanna/ NNNR Farm
3.5	What are the benefits	Income Poverty Life
3.6	What are the problems	as perceived by scientists? as perceived by local experts? as perceived by farmers?
3.7	What strategies exist to address the problems?	1) Alternatives (Land use change); 2) Cultivation techniques (Herbicide avoiding, intercropping, agroforestry) 3) Restrictions (Policies - Local Gov. Regulations e.g. Slope<25°, 800m)

No.	Question	Aspect / Variable
3.8	What are the laws & regulations that frame/influence rubber cultivaton in the area? / COMMUNITY	
3.9	How do farmers perceive sustainable rubber cultivation?	

Research Topic 4: individual factors

No.	Question	Aspect / Variable
4.1	What could be changes? (Which alternatives do they see?)	Scientific point of view Ideas of farmers
4.2	What factors concerning farming play a role?	farm size intercropping By Introduction Part
4.3	In how far do actors value ecology?	Farmers (groups)
4.4	What personal factors / motivations play a role?	World views Beliefs Moral norms Awareness of need, consequences, responsibility Social and behavioral norms
4.5	What knowledge do farmers have?	
4.6	What knowledge do they not have?	
4.7	Which factors are how important?	

Research Topic 5: conditions for acceptance of change

No.	Question	Possible factors (hypotheses)
	Economic factors	Rubber price expectation Wealth building high income social cost, externality opportunity cost compensation
	Social factors	Traditions Social system appreciation by society collective action interconnectedness within the community
	Institutional Factors	Property rights extension services / Governmental support taxes Legislation
	Knowledge	Information Channels Time Knowledge about future changes Methods of Advice

Interview Guideline 访谈指引

- picture of farm (ask!) 先询问访谈对象能否照相
- picture of rubber plantation 可以的话照一些种植园的照片

1. Objectives 目标

- We are a Student-Group from Berlin, Germany

我们是一个从德国柏林来的学生

- interested in natural resources management

我们队自然资源的管理非常感兴趣

- doing a master course in cooperation with students from CAU, Beijing

我们和中国农业大学的同学一起参与一个硕士课程的学习。

- we are here to learn more about possible changes of rubber cultivation (sustainable alternatives for rubber cultivation in general)

我们此行是为学习和了解更多在橡胶种植中可能出现的一些变化或改变。

- we know people who think that it is possible to cultivate rubber in a different way

→ Greener rubber cultivation without much economic loss

我们认识一些人，他们觉得跟现在比起来，可以有另外一种的橡胶种植方式。

更环保地种植，同时不会有太多的经济损失。

- we would like to know from you if you have own ideas or under which conditions you would accept a change in your way of growing rubber

因而我们想听听你的想法，或者是在什么条件下您会接受这些种植方法或改变现在的种植方式。

- maybe you could tell us something about this, and please tell us something about yourself first

或者您可以先给我们讲讲您的橡胶园和你自己吧。

2. Introduction Questions 访谈问题

Sociodemographic Data: 社会背景，个人信息：

Gender: (on top of the sheet) 性别：

Age年龄:

Function in the village:

您在村子的职务，如有

Name of Village: (on top of the sheet)村子的名字

Ethnical Group: (on top of the sheet)民族

Education教育程度:

Which role does rubber play in your life?

橡胶树在你的生活中意味着什么？

- size/output of rubber plantation 种植园的面积和产出
- do you already tap? 您开始割胶了吗？
- other crops than rubber? (i.e. including livestock) 您还有种有其他的吗？（包括家畜）

If yes: Which crops do you grow? And how much profit comes from rubber/how much of the area do you use for growing rubber?

假如有的话， 您种植了些什么？有多少利润是来自于种植橡胶，有多少是来自种植其他的作物？

What has changed since you started rubber cultivation?

- daily routine/life
- economic circumstances
- environment
- benefits

在种植橡胶以后，生活都有了哪些变化？

每天的生活作息

经济状况

环境

其他有利的方面

3. Problem Analysis + Solution Analysis

General opinion/reactions

- Which difficulties/ challenges do you observe coming from rubber cultivation?
- If no link to environmental problems: Do you perceive any environmental problems in the region of NNNR which are related to rubber cultivation? (i.e. soil fertility, water quality)
- How do you think your village could look like in 10 years.
- What do your children think about that? Are your children planning to be involved in rubber later?
- Did you hear about approaches concerning greener rubber? What do you think about greener rubber?

3.问题分析+解决办法

一般的意见和反应

根据你的经验或者观察，在种植橡胶过程中你都遇到哪些困难和挑战？

假如回答没有和环境问题相关：在这个保护区里，您觉得有哪些环境问题是和橡胶树相关的（例如，土壤的肥力，水的质量）

您觉得您的村子在十年后会是怎么样的？

您的孩子又是怎么看待的呢？他们有计划也种植橡胶吗？

您有没有方法让橡胶种植更加环保（少一点破坏当地的环境）？您是怎么看待“绿色”种植橡胶？

4. Case Intercropping

间种

Define intercropping 定义

Depending on reaction: What experience do you have with what we call intercropping?

根据对象的反应：您根据我们说的间种，先前您有类似的种植经历吗？

Presentation of intercropping with endangered species.

展示间种的图片，和一些珍稀树种的栽种。

Do you know the trees shown on the flyer. What do you think about combining it with rubber?

Under which conditions would you start intercropping (even after the first 7 years)? (No experience)

- finances
- labor
- training/ knowledge (by whom?)

您认出图片上的树吗？要是把他们跟橡胶树一起种的话，您觉得怎么样？

要是让您栽种这些树，您需要考虑什么条件 （甚至在7年以后）？

经济方面，劳力，知识或相关培训（谁来提供？）

What would be reasons for you not to start with intercropping?

您开始间种的原因是什么？

Why are you doing inter-cropping? (Farmer does intercropping)

您为什么要间种？

What would be helpful to keep your inter-cropping activities? (Farmer does intercropping) 哪些方面是有助于您继续间种的呢？

Why did you stop inter-cropping? (Farmer stopped)

您为什么停止了间种（假如农民终止的间种）

What would be necessary to start inter-cropping again? (Farmer stopped)

您需要什么才能再开始恢复间种？（农民终止了间种）

15. How do you think about this technique?

您觉得这个技术怎么样？

16. Strengths + weaknesses: What do you think are the effects of Intercropping for the environment/economic situation? (depending on Answer of Question 15.)

优点和缺点：您觉得间种对环境和经济都会有什么影响或效果？（根据15的回答进行询问）

5. Case Water Protection Zone

水体保护区域

21. Have you recognised any change in quality of your drinking water?

您有没有发现饮用水的质量有改变？

Presentation of Case 展示图片

22. How do you think about this technique?

您觉得这个方案怎么样？

23. Do you think that this technique would improve water quality? Why?

您觉得这个技术能改善水质吗？为什么？

24. How do you think water protection zone influence farming activities?

您觉得水源保护区会对农业活动有影响吗？

25. Under which conditions would be changes justifiable for you? (participation yes/no)

在什么条件下，您会做出改变？

27. Would you participate if the chef of the village decides so?

假如村长决定使用这个方案，您会支持和参与吗？

26. Would you participate if you get compensation for income loss?

假如您会获得额外的补偿，您会支持和参与吗？

Internal Factors

内在因素

26. What worries do you have concerning the environment in your region?

您对这个区域的环境都有哪些担忧呢？

27. To what extent does the environment play a role in the decisions you make for farming activity

我们想知道，当你们在做相关决定时，环境方面的考虑会占多大分量？

END: Do you have any questions for us?

感谢您的回答，您对我们有什么问题吗？

Posters of Case studies

Water Protection zone

Intercropping